SOIL SURVEY OF

Henry County, Missouri

United States Department of Agriculture
Soil Conservation Service
In cooperation with
Missouri Agricultural Experiment Station

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in the period 1959–62. Soil names and descriptions were approved in 1966. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1969. This survey was made cooperatively by the Soil Conservation Service and the Missouri Agricultural Experiment Station. It is part of the technical assistance furnished to the Henry County Soil and Water Conservation District.

Soil maps in this survey may be copied without permission, but any enlargement of these maps could cause misunderstanding of the detail of mapping and result in erroneous interpretations. Enlarged maps do not show small areas of contrasting soils that could have been shown at a larger mapping scale.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY of Henry County contains information that can be applied in managing farms, wildlife habitat, and woodland; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for farming, industry, and recreation.

Locating Soils

All the soils of Henry County are shown on the detailed map at the back of this survey. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the county in alphabetic order by map symbol and gives the capability classification of each. It also shows the page where each soil is described.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the discussions of the capability units, woodland suitability groups, and wildlife.

Foresters and others can refer to the section "Woodland," where the soils of the county are grouped according to their suitability for trees.

Game managers, sportsmen, and others can find information about soils and wildlife in the section "Wildlife."

Community planners and others can read about soil properties that affect parks, picnic areas, and other recreational areas in the section "Recreation."

Engineers and builders can find, under "Engineering Uses of the Soils," tables that contain estimates of soil properties and information about soil features that affect engineering practices.

Scientists and others can read about how the soils formed and how they are classified in the section "Formation and Classification of the Soils."

Newcomers in Henry County may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the information about the county given in the section "General Nature of the County."

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SOIL SURVEY OF HENRY COUNTY, MISSOURI

BY HAROLD E. GROGGER AND IVAL D. PERSINGER, SOIL CONSERVATION SERVICE

FIELDWORK BY JAMES C. BAKER, PARTY LEADER, CLARENCE L. SCRIVNER, FREDERICK L. GILBERT, RICHARD W. FENWICK, BOBBY J. MILLER, AND KENNETH D. VOGT, MISSOURI AGRICULTURAL EXPERIMENT STATION [1]

UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH THE MISSOURI AGRICULTURAL EXPERIMENT STATION

HENRY COUNTY is in the west-central part of Missouri, near the Missouri-Kansas border (fig. 1). The county mainly is an upland prairie area that has gently sloping to steep topography. The total area of the county is about 737 square miles, or 471,680 acres. Clinton is the county seat.

Farming is the main enterprise in the county. Livestock, livestock products, and cash crops are the major sources of income. The principal crops are corn, wheat, and sybeans.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in Henry County, where they are located, and how they can be used. The soil scientists went into the county knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes, the size and speed of streams, the kinds of native plants or crops, the kinds of rock, and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Barco and Eldon, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface layer and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Barco loam, 2 to 5 percent slopes, is one of several phases within the Barco series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map at the back of this publication was prepared from aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a map-

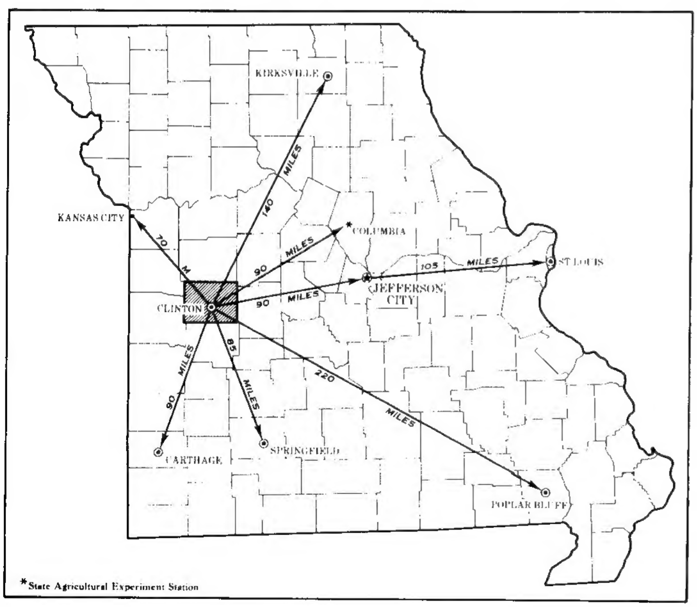

***Figure 1.*—Location of Henry County in Missouri.**

[1] CHARLES W. CROWLEY, JOE R. EAGLEMAN, and MAURICE FUGATE, Missouri Agricultural Experiment Station, contributed to the fieldwork.

ping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some kind that have seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series, or of different phases within one series. One such kind of mapping unit shown on the soil map of Henry County is the soil complex.

A soil complex consists of areas of two or more soils, so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. Generally, the name of a soil complex consists of the names of the dominant soils, joined by a hyphen. Bolivar-Rock land complex, 2 to 15 percent slopes, is an example.

In most areas surveyed there are places where the soil material is so rocky, so shallow, so severely eroded, or so variable that it has not been classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Mine pits and dumps is a land type in Henry County.

While a soil survey is in progress, soil scientists take soil samples needed for laboratory measurements and for engineering tests. Laboratory data from the same kind of soil in other places are also assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kind of soil. Yields under defined management are estimated for all the soils.

Soil scientists observe how soils behave when used as a growing place for native and cultivated plants, and as material for structures, foundation for structures, or covering for structures. They relate this behavior to properties of the soils. For example, they observe that filter fields for onsite disposal of sewage fail on a given kind of soil, and they relate this to the slow permeability of the soil or to its high water table. They see that streets, road pavements, and foundations for houses are cracked on a named kind of soil, and they relate this failure to the high shrink-swell potential of the soil material. Thus, they use observation and knowledge of soil properties, together with available research data, to predict limitations or suitability of soils for present and potential uses.

After data have been collected and tested for the key, or benchmark, soils in a survey area, the soil scientists set up trial groups of soils. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others. They then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under current methods of use and management.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in Henry County. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide in managing a watershed, a wooded tract, or a wildlife area, or in planning engineering works, recreational facilities, and community developments. It is not a suitable map for planning the management of a farm or field, or for selecting the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The soil associations in Henry County are discussed on the following pages.

1. Hartwell-Deepwater association

Deep, nearly level to moderately sloping, somewhat poorly drained and moderately well drained soils that formed in thin loess and the underlying residuum derived from shale

This association is mainly on wide divides and in undulating areas that separate the watersheds of major streams. Low benches in places in the more highly dissected parts of the county make up minor areas of the association (fig. 2.).

This association occupies about 40 percent of the county. Hartwell soils make up about 50 percent of the association, Deepwater soils 40 percent, and minor soils the remaining 10 percent.

Hartwell soils are on elevations above the adjacent Deepwater soils. These soils have a surface layer of very dark grayish-brown silt loam and a subsurface layer of grayish-brown silt loam. The upper part of the subsoil is very dark grayish-brown and grayish-brown clay, and the lower part is grayish brown and pale-brown silty clay loam. Permeability is slow, and fertility is medium. These soils are nearly level to gently sloping, are somewhat poorly drained, and have a claypan.

Deepwater soils are on points of narrow ridges and slopes. These soils have a surface layer of very dark grayish-brown and dark-brown silt loam. The subsoil is silty clay loam. The upper part is brown, the middle part is light gray and light yellowish brown, and the lower part is light brownish gray. These soils are moderately well drained. Permeability is moderate, and fertility is high.

Minor soils in this association are Roseland, Eldon, Barco, and Summit soils. Roseland soils are in the areas where shale is at a depth of as little as 2 feet. Eldon soils are in areas where cherty limestone residuum influenced their formation. Barco and Summit soils are near Deepwater soils in areas where sandstone and shale bedrock influenced their formation.

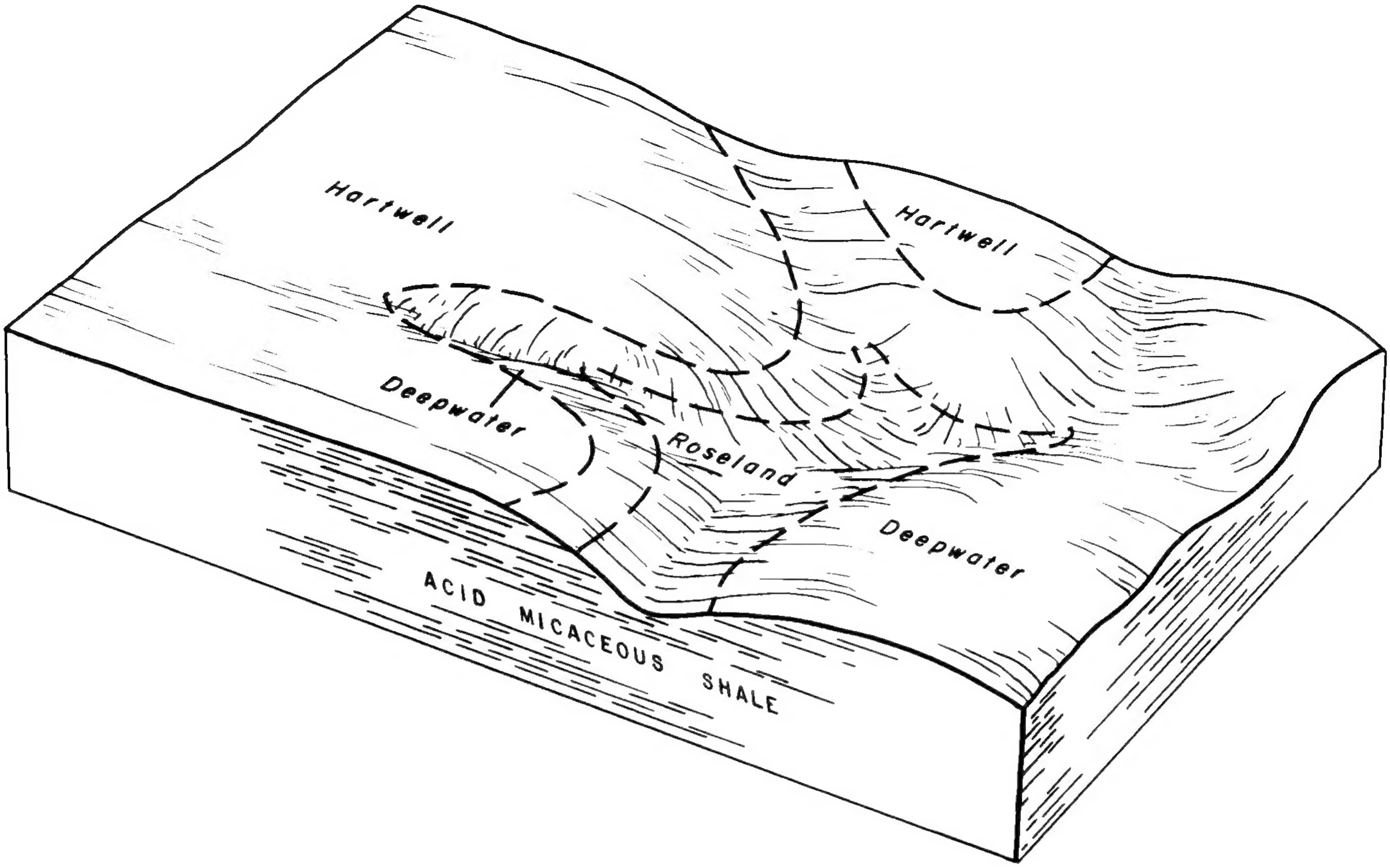

Figure 2.—**Pattern of soils and underlying material in the Hartwell-Deepwater association.**

The Hartwell and Deepwater soils are mainly in large tracts. Slopes are uniform, and large farm machinery can be used. The major crops are corn, sorghum, and soybeans. Some large areas of these soils are also used for hay. The major limitation to use of the soils in this association is susceptibility to erosion. The Hartwell soils are somewhat droughty because of their slowly permeable, clayey subsoil. The nearly level Hartwell soils that are on divides are subject to excessive wetness during wet seasons. The minor soils are in relatively small tracts and are not farmed so intensively as the major soils.

2. *Verdigris-Osage association*

Deep, nearly level, moderately well drained and poorly drained soils that formed in alluvium

This association is on the stream bottoms and along drainageways throughout the county. Width of the flood plain ranges from about 200 feet to about 2 miles.

This association occupies about 20 percent of the county. Verdigris soils make up about 31 percent of the association, Osage soils about 20 percent, and minor soils, mainly Urich, Quarles, Lightning, and Muldrow soils, the remaining 49 percent. Urich and Quarles soils are the most extensive minor soils.

Verdigris soils commonly are adjacent to the stream channels. These soils are very dark grayish-brown silt loam and show little or no horizonation. They are moderately well drained. Permeability is moderate, and fertility is high.

Osage soils commonly are between the Verdigris soils and the uplands. These soils have a surface layer of black and very dark gray silty clay loam and silty clay. The subsoil is very dark gray silty clay. They are poorly drained. Permeability is very slow, and fertility is high.

The poorly drained Urich soils commonly are near Verdigris soils in areas subject to overflow. The poorly drained Quarles soils are in valleys that have received sediment mainly from areas of Barco, Deepwater, and Hartwell soils. The poorly drained Lightning soils are on high bottoms or low terraces adjacent to Mandeville and Bolivar soils. The somewhat poorly drained Muldrow soils are in overflow positions in valleys that have received sediment mainly from Summit and Snead soils.

Where areas of this association are large enough, they are mainly in corn, soybeans, and sorghum. Many areas are in hay. Timber, brush, and grass grow in narrow meandering bands along the stream channels. Pecan trees grow throughout this association. The major limitations to use of the soils in this association are excessive wetness and flooding.

3. *Barco-Coweta association*

Moderately deep and shallow, gently sloping to moderately steep, well-drained soils that formed in residuum derived from sandstone

This association is in gently sloping to moderately steep areas along most of the major drainageways (fig. 3).

This association occupies about 13 percent of the county. Barco soils make up about 80 percent of the association, Coweta soils about 9 percent, and minor soils, mainly Hartwell, Deepwater, and Roseland soils, the remaining 11 percent.

Barco soils are influenced by sandy and silty shales. These soils have a surface layer of very dark brown loam and a subsoil of yellowish-brown clay loam that is mottled in the lower part. They are well drained. Permeability is moderate, and fertility is low to medium.

Coweta soils occur on mounds in areas of Barco soils. These soils have a surface layer of very dark grayish-brown fine sandy loam and a dark-brown fine sandy loam subsoil. They are shallow and well drained. Permeability is moderate, and fertility is low. Sandstone outcrops are common in areas of these soils.

The Hartwell and Deepwater soils are in areas below the Barco, Coweta, and Roseland soils on uplands.

The soils of this association are in medium-sized to small tracts. The Barco soils are commonly farmed where they have slopes of less than 10 percent. The major limitation to use of the soils in this association is susceptibility to erosion.

4. *Mandeville-Bolivar association*

Moderately deep, gently sloping to moderately steep, well-drained soils that formed in residuum derived from shale and sandstone

This association is in narrow areas along major drainageways (fig. 4).

This association occupies about 10 percent of the county. Mandeville soils make up about 40 percent of the association, Bolivar soils about 32 percent, and minor soils, mainly Cherokee, Norris, and Verdigris soils, the remaining 28 percent.

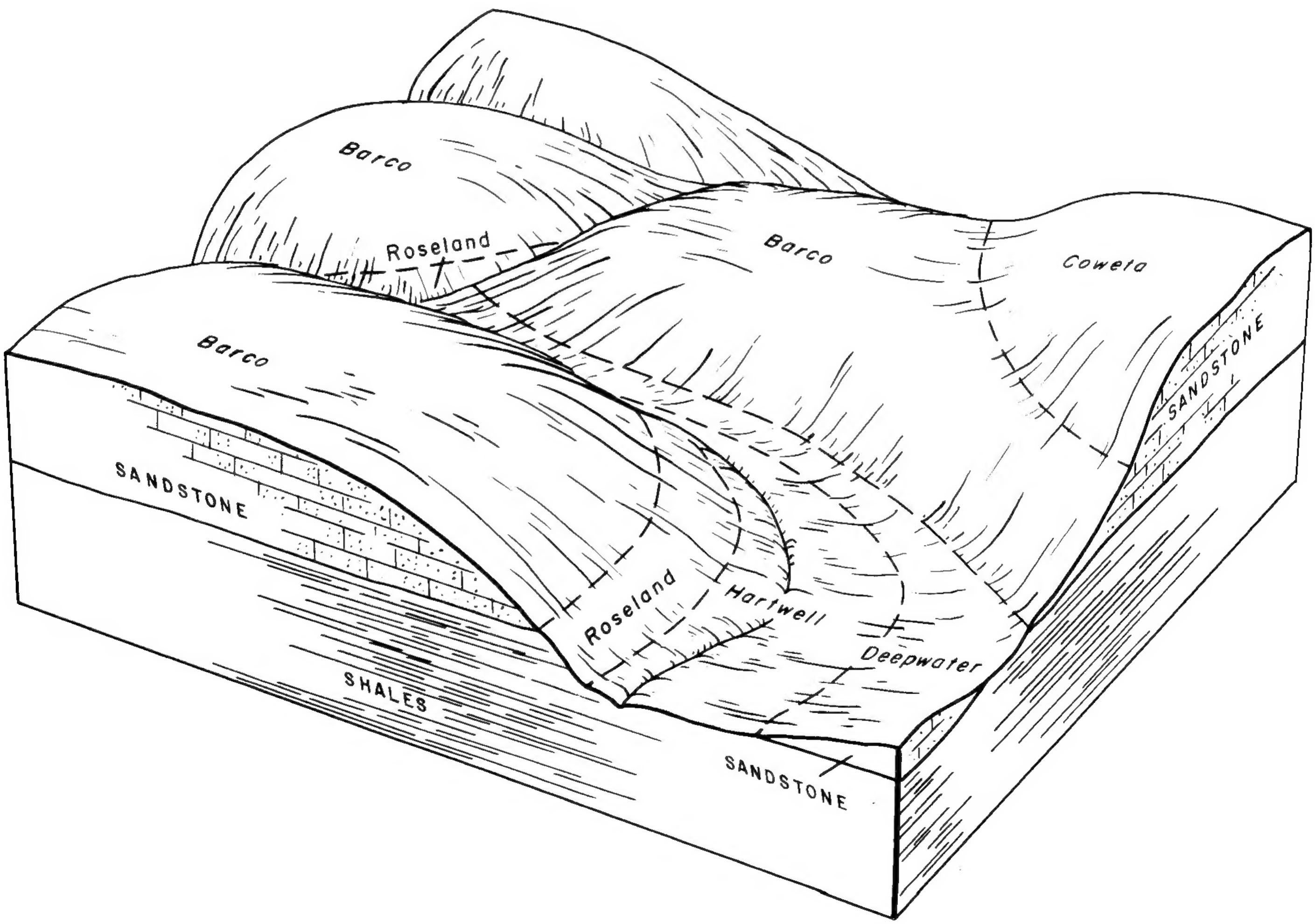

***Figure 3.*—Pattern of soils and underlying material in the Barco-Coweta association.**

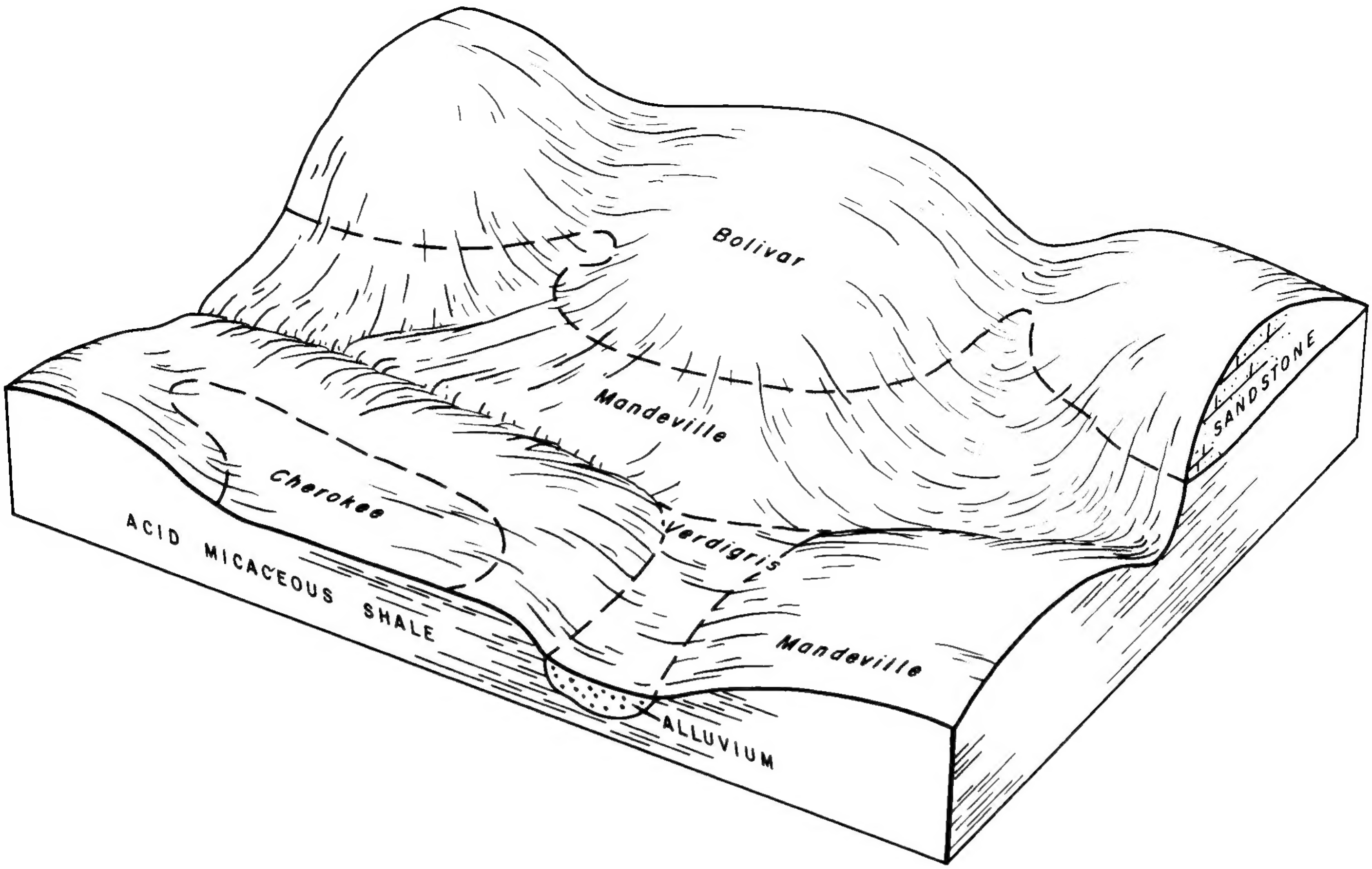

Figure 4.—Pattern of soils and underlying material in the Mandeville-Bolivar association.

Mandeville soils have a surface layer of dark grayish-brown silt loam and a subsurface layer of yellowish-brown silt loam. The subsoil is yellowish brown silt loam and loam that is mottled in the lower part. Weathered micaceous shale is at a depth of about 20 to 40 inches. Permeability is moderate, and fertility is medium.

Bolivar soils formed in parent material mostly of sandstone. These soils have a surface layer of dark grayish-brown fine sandy loam and a subsurface layer of light-brown fine sandy loam. The subsoil is mottled, reddish-brown clay loam. Thin-bedded sandstone is at a depth of 20 to 40 inches. Permeability is moderate, and fertility is low to medium.

The most common minor soils are Cherokee soils, which occur on nearly level to gently sloping divides. Norris soils are 10 to 20 inches deep over shale bedrock. They are strongly sloping to moderately steep. Verdigris soils occur on first bottoms.

The soils in this association are in medium-sized to small tracts, generally on narrow ridges or in areas that are moderately steep. The more gently sloping areas make up parts of cultivated fields, and the steeper areas are generally in grass or trees. The major limitation to use of the soils in this association is susceptibility to erosion. Droughtiness is also a limitation.

5. *Summit-Newtonia-Snead association*

Deep to moderately deep, nearly level to strongly sloping, somewhat poorly drained to well drained soils that formed in residuum derived from shale and limestone

This association is mainly in the north-central part of the county. In some areas it is characterized by a series of mounds (fig. 5). Rock outcrops are common in the strongly sloping part of the association.

This association occupies about 9 percent of the county. Summit soils make up about 45 percent of the association, Newtonia soils about 18 percent, Snead soils about 18 percent, and minor soils, mainly Rock land and Gasconade soils, the remaining 19 percent.

Summit soils formed in phosphatic shales and thin-bedded limestone. They are gently sloping to moderately sloping and somewhat poorly drained. These soils have a surface layer of black silty clay loam and a subsoil of very dark gray silty clay and clay. Permeability is slow, and fertility is high.

Newtonia soils formed in dolomitic limestone residuum. They are nearly level to gently sloping and are well drained. These soils have a surface layer of very dark brown silt loam and a subsoil of yellowish-red silty clay and clay. Permeability is moderate, and fertility is high.

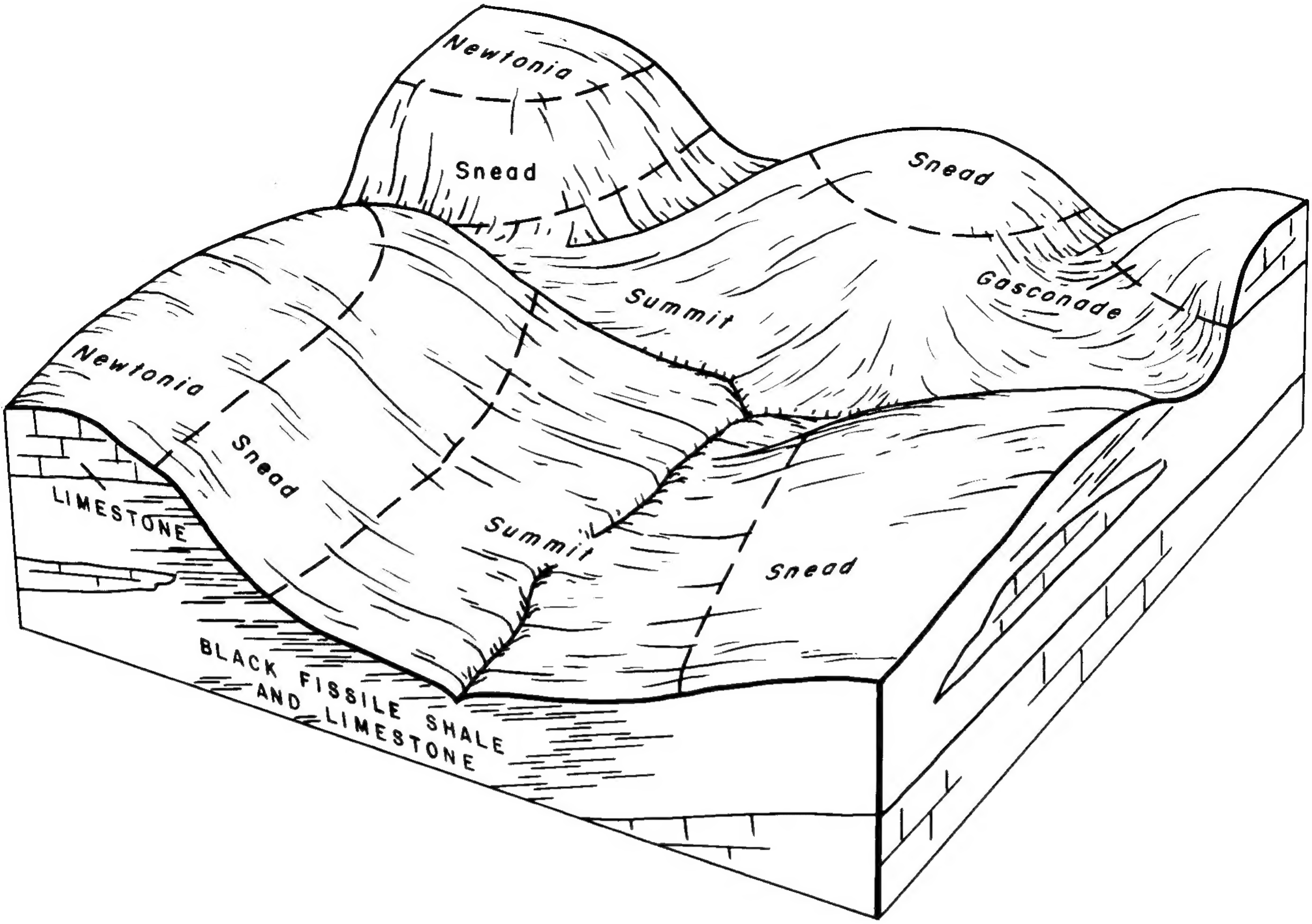

***Figure 5.*—Pattern of soils and underlying material in the Summit-Newtonia-Snead association.**

Snead soils formed in phosphatic shale. They are gently sloping to strongly sloping and are moderately well drained. These soils have a surface layer of very dark gray silty clay and a subsoil of dark grayish-brown and olive-brown silty clay. Permeability is slow, and fertility is medium.

Rock land and Gasconade soils occur in small areas throughout this association. Gasconade soils consist of areas of flaggy, very dark brown clay loam. They are less than 20 inches deep to limestone rock.

The soils of this association are in medium-sized to small tracts. Outcrops of limestone are common. The smoother slopes are used for crops, and the more complex slopes are used mainly for grass but have intermittent areas of trees. Corn, soybeans, and grass are the major crops. A large part of the area is used for grass crops (fig. 6). The major limitation to use of the soils in this association is susceptibiltiy to erosion. Droughtiness is also a limitation in the rocky areas.

6. Goss-Crider-Eldon association

Deep, gently sloping to steep, well-drained soils that formed in residuum derived from cherty limestone

This association is in the part of the county where chert limestone rocks are exposed on the surface (fig. 7). The topography is complex in many places.

This association occupies about 5 percent of the county. Goss soils make up about 60 percent of the association, Crider soils about 18 percent, Eldon soils about 16 percent, and minor soils, mainly Rock land and Gasconade and Verdigris soils, the remaining 6 percent.

Goss soils occupy narrow ridgetops and steep slopes. These soils have a surface layer of very dark brown cherty silt loam and a subsurface layer of brown cherty silt loam. The subsoil is reddish-brown cherty silty clay loam and cherty clay. Permeability is moderate, and fertility is medium.

Crider soils have low-lying slopes. These soils have a surface layer of brown silt loam and a subsoil of dark-brown and yellowish-red silty clay loam. Permeability is moderate, and fertility is medium.

Eldon soils are gently sloping to moderately steep, These soils have a surface layer of very dark brown cherty silt loam and a subsoil of dark-brown, yellowish-brown, and red cherty clay. Permeability is moderate, and fertility is medium.

Creldon soils are adjacent to Eldon soils. These soils have a cherty fragipan at a depth below about 24 inches. Rock land and the Gasconade soils are strongly sloping to steep and are on dissected uplands. Verdigris soils are on first bottoms.

Figure 6.—**Fescue harvested on soils in the Summit-Newtonia-Snead association. Newtonia soils are in the foreground, and Summit and Snead soils are in the lower area.**

The soils in this association are farmed in medium-size to small, irregularly shaped fields in the less sloping areas. Hardwood timber is in the steeper areas of Goss and Crider soils, and grass is in the steeper areas of Eldon soils. The major limitation to the use of the soils in this association is susceptibility to erosion. Droughtiness caused by the content of chert is also a limitation in steep areas.

7. *Mine pits and dumps association*

A mixture of shale, sandstone, and limestone materials in steep areas where surface mining has destroyed the natural soil

This association occurs throughout the county in areas that have been strip mined for coal. The irregularly shaped stripped areas consist of a series of high dumps and low pits. The pits generally are filled with water or form water channels in the low areas.

This association occupies about 3 percent of the county.

Strip mined areas are mostly idle. Many areas provide habitat for wildlife. Grass is established in some areas and is used for pasture. Fish are in some of the water areas. Generally, the water is too acid for suitable fish habitat.

The major limitations to use of the soils in this association are susceptibility to erosion, steepness, and irregularity of slope. Accessibility for treatment is difficult.

Descriptions of the Soils

This section describes the soil series and mapping units in Henry County. A soil series is described in detail, and then, briefly, each mapping unit in that series. Unless specifically mentioned otherwise, what is stated about the soil series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

An important part of the description of each soil series is the soil profile, that is, the sequence of layers from the surface downward to rock or other underlying material. Each series contains two descriptions of this

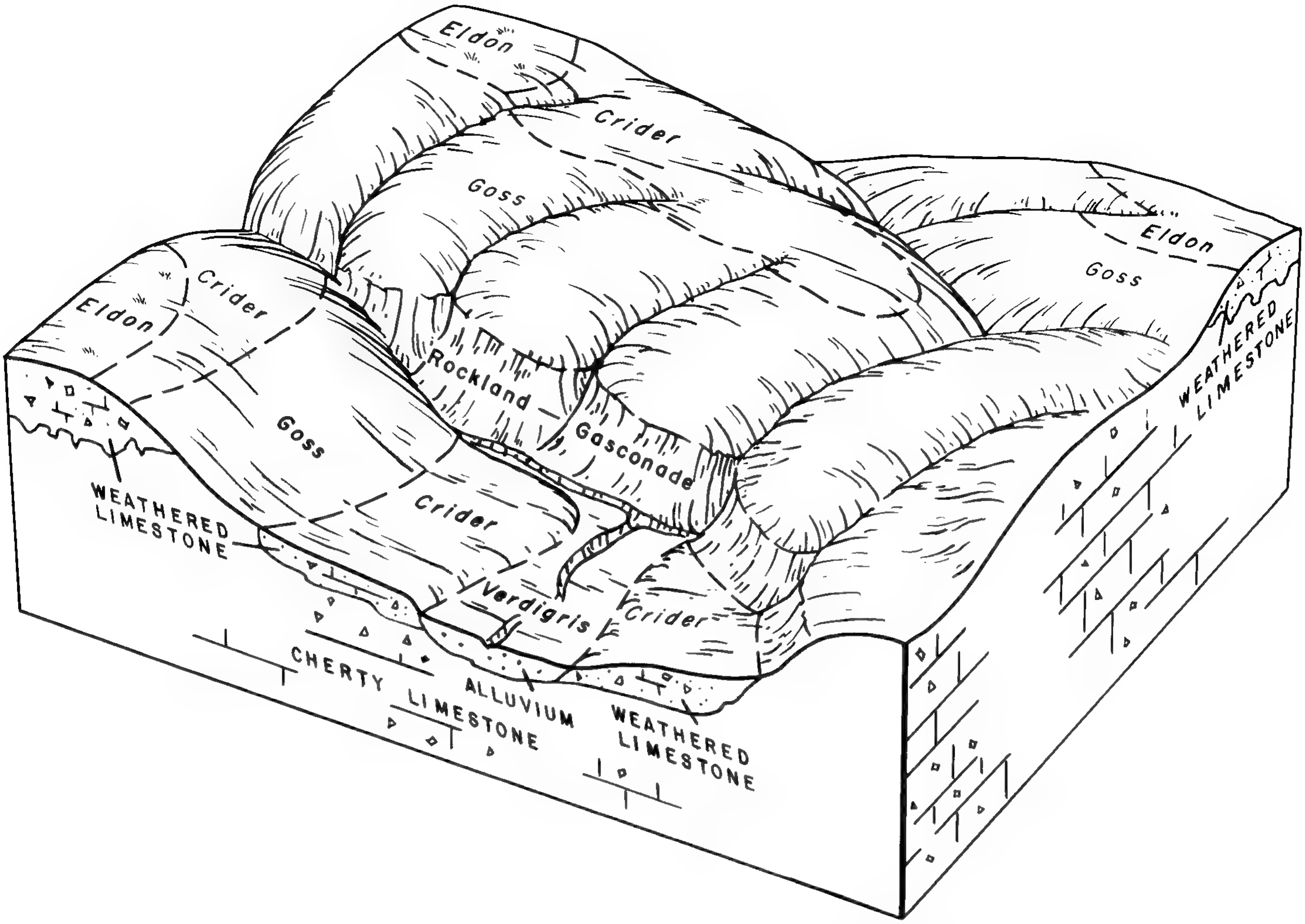

Figure 7.—**Pattern of soils and underlying material in the Goss-Crider-Eldon association.**

profile. The first is brief and in terms familiar to the layman. The second is much more detailed and is for those who need to make thorough and precise studies of soils. The profile described in the series is representative for mapping units in that series. If the profile of a given mapping unit is different from the one described for the series, these differences are stated in describing the mapping unit, or they are differences that are apparent in the name of the mapping unit. Color terms are for moist soil unless otherwise stated.

As mentioned in the section "How This Survey Was Made," not all mapping units are members of a soil series. Mine pits and dumps, for example, is a miscellaneous land type that does not belong to a soil series but nevertheless is listed in alphabetic order along with the soil series.

Following the name of each mapping unit is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit is the capability unit. The page for the description of each capability unit can be found by referring to the "Guide to Mapping Units" at the back of this survey.

The acreage and proportionate extent of each mapping unit are shown in table 1. Many of the terms used in describing soils can be found in the Glossary, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (*9*).[2]

Barco Series

The Barco series consists of moderately deep, well-drained, gently sloping to strongly sloping soils on divides on uplands. These soils formed in residuum derived from sandstone. The native vegetation is tall prairie grass.

In a representative profile the surface layer is very dark brown and very dark grayish-brown loam about 13 inches thick. The subsoil is about 26 inches thick. The upper part of the subsoil is dark grayish-brown loam, and the lower part is brown and yellowish-brown clay loam. The underlying material is light yellowish-brown weathered sandstone.

[2] Italic numbers in parentheses refer to Literature Cited, p. 71.

TABLE 1.—*Approximate acreage and proportionate extent of the soils*

Soil	Area	Extent
	Acres	*Percent*
Barco loam, 2 to 5 percent slopes	8,614	1.8
Barco loam, 2 to 5 percent slopes, eroded	10,382	2.2
Barco loam, 5 to 10 percent slopes	2,392	.5
Barco loam, 5 to 10 percent slopes, eroded	20,338	4.3
Barco loam, 5 to 15 percent slopes, severely eroded	1,136	.2
Barco loam, 10 to 20 percent slopes, eroded	728	.2
Bolivar fine sandy loam, 2 to 5 percent slopes	846	.2
Bolivar fine sandy loam, 2 to 5 percent slopes, eroded	3,236	.7
Bolivar fine sandy loam, 5 to 10 percent slopes, eroded	9,012	1.9
Bolivar fine sandy loam, 10 to 25 percent slopes, eroded	1,872	.4
Bolivar-Rock land complex, 2 to 15 percent slopes	2,466	.5
Bolivar-Rock land complex, 15 to 50 percent slopes	946	.2
Cherokee silt loam, 1 to 3 percent slopes	2,122	.5
Cherokee silt loam, 1 to 3 percent slopes, eroded	982	.2
Coweta fine sandy loam, 2 to 10 percent slopes	3,860	.8
Coweta fine sandy loam, 10 to 25 percent slopes	1,658	.4
Creldon silt loam, 2 to 5 percent slopes	822	.2
Creldon silt loam, 5 to 10 percent slopes	330	.1
Crider silt loam, 2 to 5 percent slopes	1,494	.3
Crider silt loam, 2 to 5 percent slopes, eroded	946	.2
Crider silt loam, 5 to 15 percent slopes, eroded	2,812	.6
Deepwater silt loam, 2 to 5 percent slopes	57,174	12.2
Deepwater silt loam, 2 to 5 percent slopes, eroded	32,586	6.9
Deepwater silt loam, 5 to 10 percent slopes	1,142	.2
Deepwater silt loam, 5 to 10 percent slopes, eroded	13,296	2.8
Deepwater silty clay loam, 2 to 5 percent slopes, severely eroded	578	.1
Deepwater silty clay loam, 5 to 10 percent slopes, severely eroded	670	.1
Eldon cherty silt loam, 2 to 5 percent slopes	98	(1)
Eldon cherty silt loam, 5 to 10 percent slopes	1,274	.3
Eldon cherty silt loam, 10 to 20 percent slopes	1,740	.4
Goss cherty silt loam, 2 to 15 percent slopes	7,736	1.6
Goss cherty silt loam, 15 to 50 percent slopes	5,672	1.2
Hartwell silt loam, 0 to 2 percent slopes	15,596	3.3
Hartwell silt loam, 2 to 4 percent slopes	70,658	15.0
Hartwell silt loam, 2 to 5 percent slopes, eroded	10,254	2.2
Hartwell silty clay loam, 2 to 5 percent slopes, severely eroded	184	(1)
Lightning silt loam	5,972	1.3
Mandeville silt loam, 2 to 5 percent slopes	5,198	1.1
Mandeville silt loam, 5 to 10 percent slopes, eroded	11,708	2.5
Mandeville silt loam, 10 to 25 percent slopes	1,206	.3
Mine pits and dumps	13,382	2.8
Muldrow silt loam	7,430	1.6
Newtonia silt loam, 1 to 3 percent slopes	6,976	1.5
Norris shaly loam, 10 to 25 percent slopes, eroded	3,998	.8
Osage silty clay loam	9,724	2.1
Osage silty clay loam, high bottom	1,148	.2
Osage silty clay	7,044	1.5
Quarles silt loam	9,498	2.0
Rock land-Gasconade complex, 12 to 50 percent slopes	6,226	1.3
Roseland silt loam, 2 to 10 percent slopes	5,134	1.1
Roseland silt loam, 10 to 15 percent slopes	1,652	.4
Roseland shaly silt loam, 5 to 15 percent slopes, severely eroded	640	.1
Snead silty clay, 2 to 5 percent slopes	646	.1
Snead silty clay, 2 to 5 percent slopes, eroded	732	.2
Snead silty clay, 5 to 15 percent slopes, eroded	7,232	1.5
Summit silty clay loam, 2 to 5 percent slopes	9,576	2.0
Summit silty clay loam, 2 to 5 percent slopes, eroded	3,760	.8
Summit silty clay loam, 5 to 10 percent slopes	950	.2
Summit silty clay loam, 5 to 10 percent slopes, eroded	4,896	1.0
Urich silt loam	9,826	2.1
Verdigris silt loam	36,136	7.7
Water	5,338	1.1
Total	471,680	100.0

[1] Less than 0.05 percent.

Permeability is moderate, available water capacity is moderate, and fertility is low to medium. Runoff is medium to rapid. The content of organic matter is low to high. The major limitation to use of these soils is susceptibility to erosion.

Most areas of these soils are used for crops, hay, or pasture. The principal crops are small grain, corn, sorghums, and soybeans.

Representative profile of Barco loam, 2 to 5 percent slopes, in bluegrass pasture, 1,145 feet west and 20 feet north of the southeast corner of sec. 15, T. 41 N., R. 25 W.:

A11—0 to 7 inches, very dark brown (10YR 2/2) loam; moderate, fine, granular structure; friable; medium acid; gradual, smooth boundary.

A12—7 to 13 inches, very dark grayish-brown (10YR 3/2) loam; weak, fine, subangular blocky structure; friable; strongly acid; clear, smooth boundary.

B1—13 to 18 inches, dark grayish-brown (10YR 4/2) loam; weak, fine, angular blocky structure; friable; few, small, light reddish-brown (5YR 6/4) concretions; strongly acid; clear, smooth boundary.

B21—18 to 24 inches, brown (10YR 4/3) clay loam; weak, fine, subangular blocky structure; friable; few, small, yellowish-red (5YR 4/6) concretions; strongly acid; clear, smooth boundary.

B22t—24 to 36 inches, yellowish-brown (10YR 5/4) clay loam; many, medium, distinct, red (2.5YR 4/6) mottles; moderate, medium, subangular blocky structure; friable; few soft concretions; strongly acid; clear, smooth boundary.

B23t—36 to 39 inches, light brownish-gray (10YR 6/2) clay loam; common, medium, distinct, dark-red (2.5YR 3/6) mottles; moderate, medium, subangular blocky structure; friable; few soft concretions; medium acid; clear, smooth boundary.

C—39 to 60 inches, light yellowish-brown (10YR 6/4) weathered sandstone that has thin lenses of sandy and silty shale.

The A horizon in uneroded areas ranges from 7 to 18 inches in thickness. In cultivated fields the A11 horizon is replaced by an Ap horizon. The A horizon is very dark brown (10YR 2/2) to dark brown (10YR 3/3). In places there is an A3 horizon. The B2 horizon ranges from 15 to 25 inches in thickness and from brown (10YR 4/3) to light brownish gray (10YR 6/2) and light yellowish brown (10YR 6/4) in color. Mottles range from yellowish red

(5YR 4/6) to red (2/5YR 4/6). The texture ranges from heavy loam to clay loam. In some places sandstone fragments are throughout the profile.

Barco soils are near Deepwater, Hartwell, Bolivar, and Summit soils. They have less clay in the B horizon and more sand throughout than Deepwater and Hartwell soils. They have a darker colored, thicker A horizon than Bolivar soils. They are browner in the A horizon and have less clay throughout the profile than Summit soils.

Barco loam, 2 to 5 percent slopes (BaB).—This soil is on the top of rounded ridges, on mounds, and on side slopes. In many places, it is on saddle-shaped ridgetops and side slopes below Coweta soils on mounds. Large acreages of this soil are on broad divides between the major streams. Areas of this soil are about 10 acres to more than 40 acres in size. This soil has the profile described as representative for the series.

Included with this soil in mapping are areas of Barco soils that have slopes of more than 5 per cent and a few areas of an eroded soil that has a thinner surface layer than this soil. Also included in places are areas of a soil that has bedrock at a depth of more than 40 inches, areas of Hartwell soils on the more nearly level part of some rounded ridges, and areas of a soil that has stone-size sandstone.

This soil is well suited to tillage. It has a friable surface layer that is high in organic-matter content. Natural fertility is medium. Available water capacity is moderate, and runoff is medium.

Most of this soil is used for crops. This soil is suited to corn, soybeans, sorghum, small grain, grasses, and legumes, including alfalfa. Capability unit IIe–4.

Barco loam, 2 to 5 percent slopes, eroded (BaB2).—This soil is on the top of rounded ridges, on mounds, and on side slopes. Areas of this soil are about 5 acres to 20 acres in size.

This soil has a profile similar to the one described as representative for the series, but the surface layer is browner and thinner and is commonly 4 to 7 inches thick. Also, the surface layer and the upper part of the subsoil contain a small amount of sandstone fragments. In some areas bedrock is at a depth of more than 40 inches.

Included with this soil in mapping are small areas of Coweta and Roseland soils. These soils generally are at the lower edge of areas where sandstone and shaly material is close to the surface. Also included are some areas of a soil that has sandstone rocks on the surface; small areas of uneroded Barco soils that are commonly in the center of ridges, and small areas of gently sloping Barco soils that are between natural drainageways.

This soil generally is well suited to tillage. The surface layer is less friable, is in poorer tilth, is harder when dry, and provides a less porous seedbed than the surface layer of this soil in uneroded areas. The content of organic matter is medium, and fertility is low. Available water capacity is moderate, and runoff is medium. The major limitation to the use of this soil is erosion.

This soil is suited to small grain, grasses, and legumes. If erosion practices are used, row crops can be grown without causing further erosion. Capability unit IIIe–7.

Barco loam, 5 to 10 percent slopes (BaC).—This soil is on mounds and convex side slopes. The areas are 5 acres to 40 acres in size. The areas generally are in good stands of native vegetation.

This soil has a profile similar to the one described as representative for the series, but it has steeper and shorter slopes. The surface layer ranges from 9 to 14 inches in thickness, and its color is darker in unplowed areas than in cultivated areas.

Included with this soil in mapping in places are small areas of Coweta and Roseland soils.

The content of organic matter is high, and fertility is medium. Available water capacity is moderate, and runoff is medium. The major limitation to use of this soil is susceptibility to erosion.

Short slopes and many drainageways cause an irregular cropping pattern. The major crops are native grasses, small grain, grasses, and legumes. Practices that control erosion are needed to help control soil loss and to maintain the level of organic-matter content. Capability unit IIIe–4.

Barco loam, 5 to 10 percent slopes, eroded (BaC2).—This soil is on mounds and convex side slopes. Areas of this soil are about 5 acres to 60 acres in size.

This soil has a profile similar to the one described as representative for the series, but it has a thinner and browner surface layer, and the depth to sandstone residuum is about 30 inches. The surface layer is 4 to 7 inches thick and is mixed with some clay loam material. The content of sandstone fragments is greater throughout the profile than it is in the profile described as representative for the series.

Included with this soil in mapping are small areas of uneroded Barco soils.

Slopes are short and generally are complex. The areas have several deep drainageways that have been cut by erosion. The content of organic matter is medium, and fertility is low. Available water capacity is moderate, and runoff is rapid. The major limitation to use of this soil is susceptibility to erosion.

Most of this soil is used for grasses, legumes, and small grain. Where practices to control erosion are applied, some areas are used for sorghums and other row crops. Capability unit IVe–7.

Barco loam, 5 to 15 percent slopes, severely eroded (BaC3).—This soil is on convex side slopes. The areas generally are adjacent to Coweta and Roseland soils. Areas of this soil are small.

This soil has a profile similar to the one described as representative for the series, but it has a thinner, browner surface layer, and depth to sandstone residuum is from 20 to 30 inches. The surface layer is 2 to 3 inches thick. A large amount of clay loam material from the subsoil is mixed with that in the surface layer. The upper part of the subsoil is absent in some areas. Shale and sandstone fragments are commonly on the surface and throughout the soil.

Included with this soil in mapping are areas of Coweta soils and some areas of sandstone outcrop. Also included are spots of uneroded Barco soils.

Slopes generally are complex, and many gullies are being cut. The content of organic matter is low, and

fertility is low. Available water capacity is moderate. and runoff is rapid. The major limitation to the use of this soil is susceptibiltiy to erosion.

The major crops are grasses, legumes, and small grain. Capability unit VIe–7.

Barco loam, 10 to 20 percent slopes, eroded (BaD2).—This soil is mainly in sharply breaking areas where Barco soils join Coweta or Roseland soils. Areas of this soil are small, long, and narrow.

This soil has a profile similar to the one described as representative for the series, but it has a thinner, browner surface layer and is steeper. It also has a higher content of shale and sandstone fragments throughout.

Included with this soil in mapping are areas of Coweta and Roseland soils and small areas of uneroded and severely eroded Barco soils.

Slopes are steep and short. Normally, tillage is not practiced. The content of organic matter is medium, and fertility is low. Available water capacity is moderate, and runoff is rapid. The major limitation to the use of this soil is susceptibility to further erosion.

This soil is used mainly for grass and legume meadow and pasture. It is used to a limited extent for hay or small grain. Capability unit VIe–7.

Bolivar Series

The Bolivar series consists of moderately deep, well-drained, gently sloping to moderately steep soils on ridgetops and side slopes on uplands. These soils formed in acid micaceous sandstone. The native vegetation is mainly deciduous hardwoods.

In a representative profile the surface layer is dark grayish-brown fine sandy loam about 6 inches thick and the subsurface layer is light-brown fine sandy loam about 6 inches thick. The subsoil is about 27 inches thick. The upper part of the subsoil is strong-brown, friable loam; the middle part is friable, yellowish-red clay loam; and the lower part is firm, reddish-brown clay loam. The underlying material is mottled yellowish-red and grayish-brown, soft sandstone and gray clay shale. Strong-brown sandstone is at a depth of 48 inches.

Permeability is moderate, available water capacity is moderate, and fertility is low to medium. Runoff is medium to rapid. The content of organic matter is low. The major limitation to use of these soils is susceptibility to erosion.

Most areas of these soils are used for grass, hay, and pasture. A few areas are used for crops. A large acreage remains wooded.

Representative profile of Bolivar fine sandy loam, 5 to 10 percent slopes, eroded, in a hardwood forest, 660 feet west and 20 feet south of the northeast corner of SE¼ sec. 26, T. 41 N., R. 24 W.:

A1—0 to 6 inches, dark grayish-brown (10YR 4/2) fine sandy loam; weak, fine, granular structure; very friable; medium acid; clear, smooth boundary.

A2—6 to 12 inches, light-brown (7.5YR 6/4) fine sandy loam; weak, fine, granular structure; very friable; few small manganese concretions; medium acid; clear, smooth boundary.

B1 -12 to 15 inches, strong-brown (7.5YR 5/6) loam; moderate, fine, subangular blocky structure; friable; strongly acid; clear, smooth boundary.

B21t—15 to 26 inches, yellowish-red (5YR 4/6) clay loam; moderate, fine, subangular blocky structure; thick continuous clay films; friable; very strongly acid; clear, smooth boundary.

B22t—26 to 39 inches, reddish-brown (5YR 4/4) clay loam that has few, fine, faint, red (2.5YR 4/6) mottles; moderate, medium, subangular blocky structures; firm; common red (2.5YR 4/6) sandstone fragments; very strongly acid; gradual, wavy boundary.

C—39 to 48 inches, mottled yellowish-red (5YR 4/6) and grayish-brown (10YR 5/2) soft sandstone that has thinly interbedded gray clay shale; few clay flows at the partings of the sandstone and shale; very strongly acid; gradual, wavy boundary.

R—48 to 60 inches, strong-brown (7.5YR 5/6) micaceous sandstone that has horizontal seams of light brownish-gray (2.5Y 6/2) clay between some bedding planes; strongly acid.

The Ap horizon ranges from 5 to 9 inches in thickness. In undisturbed areas the A1 horizon is very dark grayish brown (10YR 3/2) or dark grayish brown (10YR 4/2) and is about 2 to 6 inches thick. The A2 horizon ranges from dark brown (10YR 4/3) to light brown (7.5YR 6/4) in color. The A2 horizon is absent in some places because of erosion or because of mixing that results from deep plowing. The B horizon ranges from about 10 inches to more than 30 inches in thickness. The B1 horizon ranges from dark yellowish brown (10YR 4/4) to strong brown (7.5YR 5/6) in color and from 3 to 8 inches in thickness. The B2t horizon ranges from friable sandy clay loam to firm clay loam. In some places a B3t horizon is present. Thick, grayish clay films or flows are absent in the C horizon in some places.

Bolivar soils are near Coweta and Barco soils. They are deeper to sandstone than Coweta soils. They have a lighter colored or thinner A horizon than Coweta and Barco soils.

Bolivar fine sandy loam, 2 to 5 percent slopes (BoB).—This soil is in convex areas on rounded ridgetops, points, side slopes, and foot slopes. Areas of this soil are of suitable shape for farming and range from about 5 acres to more than 40 acres in size.

This soil has a profile similar to that described as representative for the series, but the surface layer is thicker and darker.

Included with this soil in mapping are areas of Barco fine sandy loam, 2 to 5 percent slopes. Some areas of soils that have a silty surface layer are at the contact between the Bolivar and Mandeville soils. Also included are some areas of soils that are more than 40 inches deep to bedrock; spots of eroded soils; and areas of soils that have slopes of more than 5 percent.

Natural fertility is medium. Available water capacity is moderate, and runoff is medium. Susceptibility to erosion limits the use of this soil. This limitation reduces the choice of crops or makes special conservation practices necessary. This soil responds well to management.

This soil is better suited to small grain, grasses, and legumes than to most other crops. It also is suited to sorghum, corn, and soybeans. It is not so well suited to timber, although a large acreage now has a cover of oaks. This soil has some potential for alfalfa. Capability unit IIIe–7.

Bolivar fine sandy loam, 2 to 5 percent slopes, eroded (BoB2).—This soil is near the slope break on

ridgetops, points, side slopes, and foot slopes. In many places the areas are small and widely separated or are dissected by drainageways. These areas range from 5 acres to more than 40 acres in size.

This soil has a profile similar to the one described as representative for the series, but the surface layer is about 8 inches of brown fine sandy loam. Erosion scars and gullies expose the lighter, brighter colored, somewhat finer textured subsoil in many places. Loamy erosional material is accumulating in the more nearly level areas downslope.

Included with this soil in mapping are areas of uneroded Bolivar soils on the crests of ridges and along drainageways, and less extensive areas of severely eroded Bolivar soils near side slope breaks. In some areas are soils that are more than 40 inches deep to bedrock. Also included are small, scattered areas or spots of Barco soils on foot slopes or at the head of drainageways.

Natural fertility is low. Available water capacity is moderate, and runoff is medium. Susceptibility to further erosion limits the use of this soil by severely restricting the choice of crops or by making very careful management necessary. Response to management is fair.

This soil is better suited to grasses and legumes than to most other crops. Small grain and an occasional crop of sorghum can be safely grown in long rotations that include hay and pasture crops. This soil is also suitable for trees. Capability unit IVe–7.

Bolivar fine sandy loam, 5 to 10 percent slopes, eroded (BoC2).—This soil is in bands on the upper edge of sharp breaks between more gently sloping and more steeply sloping Bolivar soils. Areas range fom 20 acres to more than 100 acres in size.

This soil has the profile described as representative for the series. In some areas the surface layer is light brown to brownish yellow because of removal of the original surface layer by erosion and subsequent mixing of the subsurface layer and the upper part of the subsoil. In some areas the mottled lower part of the subsoil is 6 to 12 inches closer to the surface than in the representative profile.

Included with this soil in mapping are small areas of less sloping and more steeply sloping Bolivar soils. Scattered areas of uneroded soils are also included. A few localized areas of Mandeville soils are intermingled with areas of this soil on some of the more nearly uniform slopes.

Natural fertility is low. Available water capacity is moderate, and runoff is rapid.

This soil is used mainly for small grain, grasses, and legumes. Capability unit IVe–7.

Bolivar fine sandy loam, 10 to 25 percent slopes, eroded (BoD2).—This soil is in sharply breaking areas parallel to steam valleys. Areas are long and narrow. Slopes are steeper and more complex than those of Bolivar fine sandy loam, 5 to 10 per cent slopes, eroded.

This soil has a profile similar to that described as representative for the series, but the upper horizons are somewhat thinner and thus the underlying material is closer to the surface.

Included with this soil in mapping are areas of Bolivar-Rock land complex.

Natural fertility is low. Available water capacity is moderate, and runoffs rapid. Because of the steepness and irregularity of the slopes, this soil is not suited to normal cultivation. Erosion is the major limitation.

Most areas of this soil have a cover of scattered grass and timber. Some of the more gently sloping areas show evidence of past cultivation. Capability unit VIe–7.

Bolivar-Rock land complex, 2 to 15 percent slopes (BrC).—This complex is on rolling ridges and on the upper part of adjacent slopes. Areas of this complex are 3 to 20 acres in size and are intermingled with areas of other Bolivar soils. Bolivar fine sandy loam makes up about 60 percent of the complex, and Rock land makes up about 40 percent.

The Bolivar soils in this complex have a profile similar to the one described as representative for the series. The Rock land part is limestone and sandstone outcrops and escarpments.

Included with this complex in mapping are narrow areas of colluvium and alluvium along the drainageways.

This complex is mainly in timber, scattered brush, and grass. Production of grass and trees is low, mainly because of the limited available water capacity of Rock land. The irregular topography and high rock content, in addition to the irregular shape and size of the areas, prevent effective use of conventional practices of grass or timber management. Capability unit VIIs–10.

Bolivar-Rock land complex, 15 to 50 percent slopes (BrE).—This complex is on rocky slopes adjacent to, and downslope from, the less sloping Bolivar-Rock land complex. Areas of this complex are irregular in shape and range from 10 to 40 acres in size. These areas generally are parallel to the drainageways. About 70 percent of the complex is Rock land, which consists of limestone and sandstone outcrops and escarpments. Almost all of the rest is Bolivar soils.

Included with this complex in mapping are a few small areas of colluvial and alluvial soils along narrow valleys. These soils have a thicker surface layer and fewer rocks than Bolivar soils.

This complex is mainly in timber, scattered brush, and grass. Production of grass and trees is low because of the limited available water capacity of Rock land. The steepness of slope and presence of rock prevent effective use of conventional practices of grass and timber management. Capability unit VIIs–10.

Cherokee Series

The Cherokee series consists of deep, somewhat poorly drained, nearly level to gently sloping soils on benches, terraces, and uplands. These soils formed in sediment from shale. The native vegetation is tall prairie grass and a few deciduous trees.

In a representative profile the surface layer is dark grayish-brown silt loam about 7 inches thick. The subsurface layer is light brownish-gray silt loam about 3 inches thick. The firm and very firm subsoil is about

30 inches thick. The upper part of the subsoil is dark grayish-brown clay, the middle part is grayish-brown silty clay, and the lower part is mottled gray and brownish-yellow silty clay loam. The underlying material is mottled gray and brownish-yellow silty clay loam.

Permeability is very slow, and available water capacity is moderate. Content of organic matter and natural fertility are low. Runoff is medium. A perched water table is at the top of the very firm clay subsoil during wet seasons.

Most areas of these soils are used for cultivated crops. The common crops grown are corn, sorghum, wheat, and soybeans.

Representative profile of Cherokee silt loam, 1 to 3 percent slopes, in meadow cover, 300 feet south and 1,080 feet east of the northwest corner of sec. 2, T. 40 N., R. 26 W.:

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine, granular structure; friable; slightly acid; abrupt, smooth boundary.

A2—7 to 10 inches, light brownish-gray (10YR 6/2) silt loam; weak, fine, platy structure; friable; common iron and manganese concretions; strongly acid; abrupt, smooth boundary.

B1t—10 to 12 inches, dark grayish-brown (10YR 4/2) silty clay loam; few, medium, distinct, strong-brown (7.5YR 5/6) mottles; moderate, fine, subangular blocky structure; firm; gray silt coatings on ped surfaces; strongly acid; clear, smooth boundary.

B21t—12 to 20 inches, dark grayish-brown (10YR 4/2) clay; many, medium, distinct, yellowish-red (5YR 4/6) mottles; moderate, fine, blocky structure; very firm; clay films on most ped surfaces; very strongly acid; clear, smooth boundary.

B22t—20 to 26 inches, grayish-brown (10YR 5/2) silty clay; many, coarse, distinct, yellowish-brown (10YR 5/6) mottles; moderate, medium, subangular blocky structure; firm; clay films on many ped surfaces and in root channels; strongly acid; clear, smooth boundary.

B3t—26 to 40 inches, mottled gray (10YR 6/1) and brownish-yellow (10YR 6/8) silty clay loam; weak, medium, subangular blocky structure; many clay films on ped surfaces; firm; strongly acid; gradual, smooth boundary.

C—40 to 60 inches, mottled gray (10YR 6/1) and brownish-yellow (10YR 6/8) silty clay loam; massive; firm; strongly acid.

The A horizon ranges from 6 to 14 inches in thickness. The A2 horizon is absent in some places where tillage has mixed it with the Ap horizon. The color of the Ap horizon ranges from dark gray (10YR 4/1) to grayish brown (10YR 5/2). The A2 horizon is light gray (10YR 7/1) in places. The B1t horizon is absent in places where tillage has reached through the A2 horizon. The B2t horizon ranges from 10 to 24 inches in thickness and is commonly dark gray (10YR 4/1) and dark grayish brown (10YR 4/2) in the upper part. The B3t horizon ranges from light silty clay to silty clay loam.

Cherokee soils are near the Mandeville, Bolivar, and Hartwell soils. They have a lighter colored A1 horizon and a browner Bt horizon than Hartwell soils. They have a finer textured B horizon and a grayer A2 horizon than Mandeville and Bolivar soils.

Cherokee silt loam, 1 to 3 percent slopes (ChB).—This soil is on points of ridges that extend from the broad flats occupied by Hartwell soils into timbered areas of Mandeville and Bolivar soils. In these areas forest vegetation has encroached on the ends of ridges that were once prairie. Areas range from 3 to 10 acres or larger in size. This soil has the profile described as representative for the series.

Included with this soil in mapping are some areas on the prairie margin that are as much as 10 percent Hartwell soils. Also included are some areas of soils that have a dominantly brown subsoil.

This soil is well suited to tillage, but natural fertility is low. It is slow to dry out in seasons of wetness, because it has slow permeability. In periods of low rainfall, the soil is droughty and plants are damaged by lack of available water. The major limitations to use of this soil are excessive wetness in wet seasons and droughtiness in dry seasons.

This soil is suitable for regular cropping and is used mainly for soybeans, sorghum, and small grain. Capability unit IIIw–2.

Cherokee silt loam, 1 to 3 percent slopes, eroded (ChB2).—This soil is on ridges that extend into areas of timbered Mandeville and Bolivar soils. Areas of this soil are relatively small and occur as narrow bands around areas of less eroded, more nearly level Cherokee soils. Because of very slow internal water movement, water accumulates in the more nearly level areas and causes erosion as it flows across the margins. The original surface layer is friable and is easily detached. In cultivated fields erosion has resulted.

This soil has a profile similar to that described as representative for the series, but the surface layer is lighter colored. Part of the original surface layer has been removed by erosion, and the subsurface layer has been mixed with the rest of the original surface layer by tillage, making the plow layer lighter colored than that of the uneroded soil. In places where most of the surface layer and subsurface layer have been removed, the texture ranges to heavy silt loam or light silty clay loam. In some areas this soil has a dominantly brown subsoil. This soil has a claypan.

Included with this soil in mapping are small areas of uneroded Cherokee silt loam, 1 to 3 percent slopes.

Natural fertility is low, permeability is very slow, and available water capacity is moderate. This soil is slow to dry out in spring and fall and is droughty in summer.

This soil is suited to regular cropping, but proper selection of crops, use of crop residue, and erosion control are necessary parts of good management. Soybeans, sorghum, small grain, and fescue are the major crops. Capability unit IIIe–6.

Coweta Series

The Coweta series consists of shallow, well-drained, gently sloping to moderately steep soils on uplands. These soils formed in residuum weathered from soft sandstone interbedded with shale. The native vegetation is tall prairie grasses.

In a representative profile the surface layer is very dark grayish-brown fine sandy loam about 12 inches thick. The subsoil is friable, dark-brown fine sandy loam about 6 inches thick. The underlying material is strong-brown, brown, and brownish-yellow soft sandstone and soft, sandy shale.

Permeability is moderate, available water capacity is low, and content of organic matter is high. Natural

fertility is low, and runoff is medium to rapid. The major limitations to the use of these soils are droughtiness and susceptibility to erosion.

Most areas of these soils are used for pasture. A few small areas are used for cultivated crops.

Representative profile of Coweta fine sandy loam, 2 to 10 percent slopes, in an idle field, 660 feet west and 660 feet south of northeast corner of NW1/4 sec. 28, T. 41 N., R. 25 W.:

A1—0 to 12 inches, very dark grayish-brown (10YR 3/2) fine sandy loam; moderate, fine, granular structure; very friable; 15 percent coarse fragments; medium acid; clear, smooth boundary.

B2—12 to 18 inches, dark-brown (7.5YR 4/4) fine sandy loam; moderate, fine, granular structure; friable; 25 percent coarse fragments 1 to 6 inches in diameter; strongly acid; gradual, smooth boundary.

C—18 to 28 inches, strong-brown (7.5YR 5/6), brown (7.5YR 4/4), and brownish-yellow (10YR 6/8) soft sandstone and interbedded soft sandy shale; strongly acid.

The solum ranges from 10 to 20 inches in thickness. The A1 horizon is medium acid or strongly acid, and content of coarse fragments ranges from 5 to 20 percent. The B2 horizon ranges from about 2 to 12 inches in thickness. Content of coarse fragments in the B2 horizon ranges from 20 to 30 percent, and the fragments are mostly soft sandstone. The C horizon is strong-brown (7.5YR 5/6) and dark-brown (7.5YR 4/4), soft, acid sandstone interbedded with brownish-yellow (10YR 6/8) and pale-brown (10YR 6/3), soft, sandy shale. The C horizon can be dug with a spade and has hardness of 3 (Mohs scale).

Coweta soils are near Barco and Bolivar soils. They are coarser textured and shallower to soft sandstone and shale bedrock than Barco soils. Coweta soils have a darker colored A horizon, a coarser textured B horizon, and shallower depth to soft sandstone bedrock than Bolivar soils. Coweta and Norris soils have similar depths to bedrock, but Coweta soils formed in soft sandstone and sandy shale and Norris soils formed in soft micaceous shale.

Coweta fine sandy loam, 2 to 10 percent slopes (CoC).—This soil is on knobs, ridgetops, ridge points, and side slopes. Areas are generally elongated, are parallel to drainageways, and range from about 5 acres to more than 80 acres in size.

This soil has the profile described as representative for the series.

Included with this soil in mapping are small areas of Barco soils, some areas of Bolivar soils, and a few areas of more sloping Coweta soils. These included soils generally make up less than 15 percent of each mapped area. Outcrops of sandstone are common. In some places the included Barco soils are in small, less sloping saddles. The Bolivar soils have steeper slopes and occur under forest vegetation.

Irregular, choppy slopes and occasional rock outcrops make this soil generally unsuited to tillage. Available water capacity and natural fertility are low. Runoff is medium. The major limitation to the use of this soil is droughtiness.

This soil is mainly used for pasture, and careful selection of grass and legume varieties is necessary. Capability unit VIs–8.

Coweta fine sandy loam, 10 to 25 percent slopes (CoD).—This soil is on knobs and side slopes. Sandstone outcrops are common, and most slopes are irregular. Areas are irregular in shape and range from 5 acres to more than 80 acres in size.

This soil has a profile similar to that described as representative for the series, but the surface layer and subsoil are thinner, slopes are steeper and more broken, and more rock outcrops are on the surface.

Included with this soil in mapping are small areas of less sloping Barco soils and some areas of less sloping Coweta soils.

Available water capacity and natural fertility are low. Runoff is rapid. The major limitation to the use of this soil is droughtiness.

The steep, irregular slopes, the thin surface layer and subsoil, and common rock outcrops make this soil unsuited to cultivation. Proper selection of grass and legume varieties and management of pasture are necessary practices. Capability unit VIIs–8.

Creldon Series

The Creldon series consists of deep, moderately well drained, gently sloping to moderately sloping soils on uplands. These soils have a fragipan at a depth of 18 to 36 inches. They developed in 18 to 36 inches of loess over cherty residuum weathered from limestone. The native vegetation is tall prairie grasses.

In a representative profile the surface layer is about 18 inches thick. The upper part of the surface layer is very dark brown silt loam, and the lower part is very dark grayish-brown silty clay loam. The upper 11 inches of the subsoil is firm silty clay loam that is brown in the upper part and mottled grayish brown and yellowish brown in the lower part. The next 8 inches is a fragipan of gray and yellowish-brown silt loam. The lower part of the subsoil is mottled yellowish-brown, yellowish-red, reddish-brown, and brownish-yellow clay. Limestone bedrock is at a depth of 62 inches.

Permeability is slow available water capacity is moderate and content of organic matter is high. Natural fertility and runoff are medium. The major limitation to use of these soils is susceptibility to erosion.

Most areas of these soils are used for hay or pasture. A few areas are used for cultivated crops.

Representative profile of Creldon silt loam, 5 to 10 percent slopes, in mixed pasture, 1,020 feet north and 20 feet west of the middle of sec. 11, T. 41 N., R. 24 W.:

A1—0 to 12 inches, very dark brown (10YR 2/2) silt loam; moderate, fine, granular structure; very friable; strongly acid; gradual, smooth boundary.

A3—12 to 18 inches, very dark grayish-brown (10YR 3/2) silty clay loam; weak, fine, granular structure; friable; strongly acid; clear, smooth boundary.

B21t—18 to 24 inches, brown (10YR 4/3) silty clay loam; weak, fine, subangular blocky structure; firm; dark-brown (10YR 3/3) coatings on ped surfaces; strongly acid; clear, smooth boundary.

B22t—24 to 29 inches, mottled grayish-brown (10YR 5/2) and yellowish-red (5YR 5/8) silty clay loam; moderate, fine, subangular blocky structure; firm; dark grayish-brown (10YR 4/2) coatings on some ped surfaces; scattered fine chert fragments and hard black concretions; very strongly acid; clear, smooth boundary.

IIB'x –29 to 37 inches, light-gray (10YR 7/2) and yellowish-brown (10YR 5/4) silt loam; slightly brittle when dry, friable when moist; very dark gray

(10YR 3/1) clay fillings in cracks and pores of chert fragments (50 percent by volume); medium acid; clear, wavy boundary.

IIB31—37 to 42 inches, coarsely mottled light yellowish-brown (10YR 6/4) and yellowish-red (5YR 5/6) clay; weak, medium, subangular blocky structure; very firm; few, fine cherty fragments (20 percent by volume); medium acid; gradual, wavy boundary.

IIB32—42 to 62 inches, mottled reddish-brown (2.5YR 4/4), yellowish-red (5YR 4/6), and brownish-yellow (10YR 6/6) clay; very firm; few fine cherty fragments (10 percent by volume); limonite and carbonate concretions; slightly acid.

IIC—62 inches, limestone bedrock.

The A horizon ranges from 6 to 20 inches in thickness. Reaction is generally strongly acid or medium acid but ranges to neutral where limed. In most places the A horizon contains a few fragments of chert. The B horizon is 10 to 22 inches thick and ranges from slightly acid to very strongly acid. The B21t horizon ranges from dark brown (7.5YR 3/2) to dark yellowish brown (10YR 4/4) in color and from 3 to 8 inches in thickness. The B22t horizon ranges from yellowish red (5YR 5/8) to grayish brown (10YR 5/2) in color and is silty clay loam, light silty clay, or cherty analogs. The fragipan ranges from 8 to 40 inches in thickness and is strongly acid to medium acid in reaction. The chert content of the fragipan ranges from less than 35 percent to about 80 percent. In a few places, the chert content is more than 35 percent in the B horizon. Limestone bedrock or fragmental chert is at a depth of 5 feet to more than 8 feet.

In mapping units CrB and CrC, the B horizon is grayer than is defined as within the range for the series, but this difference does not alter the usefulness or behavior of the soils.

Creldon soils are near Newtonia, Hartwell, Cherokee, and Eldon soils. They have a fragipan, which is lacking in the Newtonia and Hart well soils. Creldon soils lack the abrupt texture change in the B horizon that is in the Cherokee soils. Creldon soils lack the chert in the upper 24 inches that is present in the Eldon soils.

Creldon silt loam, 2 to 5 percent slopes (CrB).—This soil is on ridgetops and side slopes. Areas are small and scattered and commonly occur where the Pennsylvanian and Mississippian rocks merge.

Included with this soil in mapping are small areas of Hartwell soils on the broader ridges adjoining this Creldon soil. Also included in places are small areas of Deepwater soils in which the depth to the cherty substratum is in excess of 36 to 40 inches.

The soil is friable and is well suited to tillage. Natural fertility and runoff are medium. Available water capacity is moderate. The major limitations to the use of this soil are susceptibility to erosion and droughtiness.

This soil is used mainly for cultivated crops, pasture, and hay. It is suited to small grain, sorghum, soybeans, grasses, and legumes. Capability unit IIe–5.

Creldon silt loam, 5 to 10 percent slopes (CrC).—This soil is on ridgetops and side slopes. It occurs in small areas where the Pennsylvanian and Mississippian geologic materials merge. Slopes are commonly irregular and short.

This soil has the profile described as representative for the series.

Included with this soil in mapping are small areas of soils that have a slightly browner surface layer and a more reddish-brown subsoil. These areas occur at the boundary of the steeper Goss soils. Also included are a few small areas of gently sloping Creldon soils.

Natural fertility and runoff are medium. Available water capacity is moderate. The major limitations to the use of this soil are susceptibility to erosion and droughtiness.

This soil is mainly used for small grain, hay, and pasture. It is suited to these uses. Capability unit IIIe–5.

Crider Series

The Crider series consists of deep, well-drained, gently sloping to strongly sloping soils on high terraces, benches, and uplands. These soils formed in loess and the underlying cherty limestone residuum. The native vegetation is mainly mixed hardwoods.

In a representative profile the surface layer is brown silt loam about 9 inches thick. The firm subsoil is about 59 inches thick. The upper 18 inches of the subsoil is dark-brown silty clay loam, and the lower 41 inches is yellowish-red clay loam. The underlying material is weathered cherty limestone.

Permeability is moderate, available water capacity is high, and content of organic matter is moderate. Natural fertility is medium, and runoff is medium to rapid.

Most areas of these soils are used for cultivated crops and pasture. Some areas remain wooded.

Representative profile of Crider silt loam, 2 to 5 percent slopes, in a pasture 200 feet east and 30 feet north of center of sec. 12, T. 41 N., R. 24 W.:

Ap—0 to 6 inches, brown (10YR 4/3) silt loam; weak, very fine, granular structure; friable; medium acid; gradual, smooth boundary.

A12—6 to 9 inches, brown (10YR 4/3) silt loam: moderate, fine, granular structure; friable; medium acid; clear, smooth boundary.

B1t—9 to 12 inches, dark-brown (7.5YR 4/4) silt loam; moderate, very fine, subangular blocky structure; friable; thin, patchy clay films on ped surfaces; medium acid; gradual, smooth boundary.

B21t—12 to 21 inches, dark-brown (7.5YR 4/4) silty clay loam; moderate, fine, subangular blocky structure; firm; thin, continuous, reddish-brown (5YR 4/4) clay films; medium acid; gradual, smooth boundary.

B22t—21 to 27 inches, dark-brown (7.5YR 4/4) silty clay loam; moderate, fine, subangular blocky structure; firm; thick, continuous, dark reddish-brown (5YR 3/4) clay films on ped surfaces; strongly acid; gradual, wavy boundary.

B31t—27 to 42 inches, yellowish-red (5YR 4/6) clay loam; weak, medium, subangular blocky structure; firm; dark reddish-brown (5YR 3/4) clay films on vertical ped surfaces; few, scattered, black manganese stains; strongly acid; gradual, wavy boundary.

B32t—42 to 68 inches, yellowish-red (5YR 4/6) clay loam; weak, medium, subangular blocky structure; firm; common clay films on concretions; medium acid; gradual, wavy boundary.

C—68 inches, yellowish-red (5YR 4/6) and strong-brown (7.5YR 5/6) partly weathered cherty limestone; clay loam in cracks and interstices; firm.

The A horizon ranges from dark grayish brown (10YR 4/2) to brown (10YR 5/3) in color and from 6 to 15 inches in thickness. The B horizon ranges from 30 inches to more than 60 inches in thickness. Depth to cherty limestone ranges from 4 feet to more than 10 feet.

These soils have a greater capacity to hold and exchange base elements than is defined as within the range for the series, but this difference does not alter the usefulness or

behavior of the soils. They also lack clay texture in the lower part of the B horizon.

Crider soils are near Goss soils and developed in thin loess over Mississippian rocks. They have less clay in the B2 horizon and less chert in the A and B horizons than Goss soils.

Crider silt loam, 2 to 5 percent slopes (CsB).—This soil is on old high terraces or benches. It is minor in extent and occurs in areas that are generally 3 to 5 acres in size.

This soil has the profile described as representative for the series.

Included with this soil in mapping are a few minor spots of soils that have a cherty surface layer and subsoil. These areas occur where the Crider soils join the steeper Goss soils. Also included in places are small areas where slope is more than 5 percent and spots where erosion has removed the surface layer. In a few areas, particularly on the lower elevations, lag gravel lines are evident in the lower part of the subsoil.

The areas of this soil are normally cropped. Natural fertility is medium, and available water capacity is high. Content of organic matter is moderate, and runoff is medium. This soil is subject to erosion.

This soil is suited to row crops, small grain, legumes, and grasses. It is well suited to alfalfa. Capability unit IIe–1.

Crider silt loam, 2 to 5 percent slopes, eroded (CsB2).—This soil is on the edges of ridges of high benches. Areas are scattered and are generally less than 10 acres in size.

This soil has a profile similar to that described as representative for the series, but most of the original surface layer has been removed by erosion and the remaining plow layer consists of a mixture of the original surface layer and the upper part of the subsoil. The surface layer contains more clay and in places is silty clay loam. The subsoil is somewhat thinner, and the cherty limestone parent rock is closer to the surface.

Included with this soil in mapping in places are areas of soils that have small chert fragments in the surface layer and subsoil. These soils have the steeper, more eroded slopes. Also included in places are areas, generally near the center of ridges, where the soils are not eroded.

Natural fertility is medium, and available water capacity is high. Runoff is medium. The major limitations to use of this soil are susceptibility to erosion together with damage to the soil from past erosion.

This soil is used for crops and hay. It is suited to corn, sorghum, small grain, grasses, and legumes, including alfalfa. Capability unit IIe–1.

Crider silt loam, 5 to 15 percent slopes, eroded (CsC2).—This soil is on the sharply breaking edges of high benches. Areas are irregular in shape and range from 5 to 30 acres in size.

This soil has a profile similar to that described as representative for the series, but the original surface layer has been removed by erosion and the remaining exposed soil has a higher clay content. The texture is silty clay loam in spots. Some chert fragments are in the surface layer and subsoil, and the cherty underlying material is normally closer to the surface.

Included with this soil in mapping are small areas of Goss soils. Also included are small areas of less sloping Crider soils and small localized spots of uneroded soils.

Natural fertility is medium. Available water capacity generally is high, but it is lower in the more severely eroded spots. Runoff is rapid. The major limitations to the use of this soil are susceptibility to erosion and damage to the soil from past erosion. Response to proper management is good.

Areas of this soil were cropped intensively in the past but are now mostly in small grain or hay and meadow crops. The soil is well suited to hay and pasture. Control of erosion is a necessary part of good management. Capability unit IIIe–1.

Deepwater Series

The Deepwater series consists of deep, moderately well drained, gently sloping to moderately sloping soils on upland divides. These soils formed in residuum weathered from shale and covered with a thin loess mantle. The native vegetation is tall prairie grasses.

In a representative profile the surface layer is silt loam about 18 inches thick. The upper part is very dark grayish brown, and the lower part is dark brown. The subsoil is silty clay loam that extends to a depth of more than 60 inches. The upper part is brown and friable, the middle part is light gray and light yellowish brown and firm, and the lower part is light brownish gray and firm and has shale fragments.

Permeability is moderate, available water capacity is high to very high, and content of organic matter is medium to high. Natural fertility is high, and runoff is medium to rapid.

Most areas of these soils are used for cultivated crops and hay. Some areas are used for pasture.

Representative profile of Deepwater silt loam, 2 to 5 percent slopes, in a bluegrass pasture 1,370 feet north and 30 feet west of the southeast corner of sec. 33, T. 42 N., R. 26 W.:

A1—0 to 14 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, medium, granular structure; friable; many fine roots; neutral; clear, smooth boundary.

A3—14 to 18 inches, dark-brown (10YR 4/3) silt loam; weak, fine, subangular blocky structure; friable; common fine roots; medium acid; clear, smooth boundary.

B21t—18 to 23 inches, brown (10YR 5/3) silty clay loam; moderate, fine, subangular blocky structure; friable; few fine roots; patchy pale-brown (10YR 6/3) silt coatings on ped surfaces; few dark concretions; strongly acid; clear, smooth boundary.

B22t—23 to 28 inches, brown (10YR 4/3) silty clay loam; moderate, medium, subangular blocky structure; firm; thin, continuous, dark grayish-brown (10YR 4/2) clay films on ped surfaces; few dark concretions; strongly acid; clear, smooth boundary.

B23t—28 to 46 inches, mottled light yellowish-brown (10YR 6/4) and light-gray (10YR 7/2) silty clay loam; moderate, medium, subangular blocky structure; firm; discontinuous black (10YR 2/1) clay films; medium acid; gradual, smooth boundary.

B24t—46 to 62 inches, mottled light brownish-gray (10YR 6/2) and yellowish-brown (10YR 5/6) silty clay loam; moderate, medium, subangular blocky structure; firm; few fine shale fragments; slightly acid.

The A1 horizon ranges from 10 to 18 inches in thickness and from black (10YR 2/1) to very dark grayish brown (10YR 3/2) in color. The A3 horizon ranges from 3 to 6 inches in thickness and from very dark grayish brown (10YR 3/2) to dark brown (10YR 4/3) in color. The B2 horizon ranges from strongly acid to slightly acid and in most places becomes less acid with depth.

Deepwater soils are near Barco, Hartwell, and Summit soils. They have more clay in the B horizon than Barco soils and are underlain by shale, whereas Barco soils are underlain by sandstone. They lack an A2 horizon, which Hartwell soils have. Deepwater soils are more acid and are not so dark colored as Summit soils.

Deepwater silt loam, 2 to 5 percent slopes (DeB).—This soil is on rounded ridgetops, ridge points, and side slopes. Areas are extensive and range from 10 to 40 acres or more in size.

This soil has the profile described as representative for the series.

Included with this soil in mapping are areas of soils that have a surface layer of loam and occur near the borders of delineations where the soils merge with areas of Barco soils. Also included in places are areas of moderately sloping soils that have a subsoil of clay loam. These areas occur in localized spots where erosion has removed the surface layer. Also included are local areas of eroded soils that have a lighter colored surface layer and a few areas of soils that are nearly level and have a grayer surface layer and a subsoil that has more clay than normal.

This soil generally has long, gentle slopes and is well suited to tillage. Available water capacity is very high, and content of organic matter is high. The surface layer is friable, and natural fertility is high. Runoff is medium. The main limitation to the use of this soil is susceptibility to erosion.

Most of this soil is cropped. It is suited to corn, sorghum, soybeans, small grain, grasses, and legumes. Control of erosion is a necessary part of good management. Capability unit IIe–1.

Deepwater silt loam, 2 to 5 percent slopes, eroded (DeB2).—This soil is at the steeper margins of rounded ridgetops, on ridge points, and on side slopes. Past cropping without adequate erosion control practices has resulted in the removal of half or more of the original surface layer. This soil makes up nearly one-fourth of the acreage of the Deepwater soils. Areas range from 5 to 30 acres or more in size.

This soil has a profile similar to that described as representative for the series, but the surface layer is only 5 to 8 inches thick and its boundary with the subsoil has been mixed by tillage. Because material from the upper part of the subsoil has been mixed with the original surface layer, the plow layer is higher in content of clay and in places approaches silty clay loam. In places the surface layer is brown.

Included with this soil in mapping are areas of soils, where Deepwater and Barco soils merge, that have a surface layer of loam. Localized areas of noneroded soils on ridge points and between drainage channels are common. Also included are small isolated areas of Roseland soils where the shale parent material crops out or is within 20 inches of the surface. Areas of Hartwell soils or soils that have a more clayey subsoil are common.

Available water capacity is very high, and natural fertility is high. Runoff is medium. The major limitation to the use of this soil is susceptibility to erosion.

Most of this soil has been cropped and is suited to row crops, small grain, grasses, and legumes. Capability unit IIe–1.

Deepwater silt loam, 5 to 10 percent slopes (DeC).—This soil is on side slopes and foot slopes and, to a limited extent, on narrow ridges. It occurs mainly in areas that have been used largely as grassland and have not been eroded. Areas are irregular in shape.

Included with this soil in mapping are localized areas of soils that have a surface layer of loam and that have a higher content of sand in the subsoil. Also included are areas of soils where the sandstone parent material is within 30 inches of the surface and areas where spot erosion has occurred.

Availiable water capacity is very high, and natural fertility is high. Runoff is rapid. The major limitation to the use of this soil is susceptibility to erosion. Slopes are slightly irregular for the layout of terrace systems.

This soil is suited to crops, including row crops, small grain, grasses, and legumes. Capability unit IIIe–1.

Deepwater silt loam, 5 to 10 percent slopes, eroded (DeC2).—This soil is on side slopes and foot slopes. It is quite uniform where it occurs in broad expanses. Slopes are irregular and are complex in places.

This soil has a profile similar to that described as representative for the series, but the surface layer is generally thinner because of removal by erosion, and the plow layer consists of a mixture of the original surface layer and the subsoil. The surface layer has a higher content of clay and is browner because some material from the subsurface layer has been mixed with it.

Included with this soil in mapping are areas of Barco and Summit soils. In areas near Barco soils, the surface layer is loam and sandstone fragments are throughout the subsoil. In areas near Summit soils, the subsoil is somewhat less brown and is mottled. In some small isolated spots, shale outcrops on the surface.

Available water capacity is very high, and natural fertility is high. Runoff is rapid. The major limitations to the use of this soil are susceptibility to erosion and damage from past erosion.

This soil is used for crops, hay, and pasture. It is well suited to these uses. The control of erosion is a necessary part of good management. Capability unit IIIe–1.

Deepwater silty clay loam, 2 to 5 percent slopes, severely eroded (DpB3).—This soil is mainly at the head of gently sloping drainageways where erosion has produced a network of gullies and has removed essentially all of the surface layer. Slopes are irregular, are commonly complex, and are marked with gullies that vary in depth.

This soil has a profile similar to that described as representative for the series, but it has a surface layer of brown silty clay loam. The plow layer consists mainly of subsoil material. Mottled color patterns in

the subsoil commonly are within 12 inches of the surface, consistence is more firm, and structure is more blocky and coarser.

The presence of gullies and subsequent mixing of shale in the underlying material is common in spots. The shaly material is normally clayey but is sandy in localized spots where the soil is influenced by underlying sandstone.

Available water capacity is high, and content of organic matter is moderate. Runoff is rapid. The main limitations to the use of this soil are susceptibility to erosion, damage from past erosion, and higher than normal runoff.

This soil is used mainly for crops and pasture. It is suited to limited use for row crops, small grain, grasses, and legumes. Fescue grass grows well with proper management. Capability unit IIIe–4.

Deepwater silty clay loam, 5 to 10 percent slopes, severely eroded (DpC3).—This soil is mainly on side slopes where erosion has removed the topsoil and produced many gullies in places. Slopes are irregular, are commonly complex, and have many gullies that vary in depth.

This soil has a profile similar to that described as representative for the series, but the surface layer is browner and is silty clay loam because material from the subsoil has been mixed with it. The upper part of the subsoil is thinner and is absent in spots on the sides of gullies where erosion has exposed the middle and lower parts of the subsoil. Mottled colors are on or near the suface in the most severely eroded spots. The surface layer is hard when dry and plastic when wet.

Included with this soil in mapping are common areas of soils that have been subject to gully cutting and subsequent filling and removal by tillage and other causes. Outcrops of shaly material are common on the exposed gully sides. Most of the fragments are shale, but sandstone fragments are common. Also included in natural drainageways are elongated areas that are accumulations of silty colluvial material washed from adjacent slopes.

Available water capacity is high, and content of organic matter is moderate. Runoff is rapid.

This soil is used mainly for pasture. It is suited to limited use for corn, sorghum, small grain, grasses, and legumes. Capability unit IVe–4.

Eldon Series

The Eldon series consists of deep, well-drained, gently sloping to moderately steep soils on low mounds and upland ridges. These soils formed in residuum from limestone. The native vegetation is tall prairie grasses.

In a representative profile the surface layer is cherty silt loam about 17 inches thick. The upper part is very dark brown, and the lower part is dark brown. The subsoil extends to a depth of more than 60 inches. The upper part of the subsoil is dark-brown, firm, very cherty silty clay loam, the middle part is yellowish-brown and red, very firm, cherty clay, and the lower part is red and very pale brown, very firm, cherty clay.

Permeability is moderate, available water capacity is low, and content of organic matter is high. Natural fertility is medium, and runoff is medium to rapid. The major limitation to use of these soils is susceptibility to erosion.

Most areas of these soils are used for small grain, hay, or pasture.

Representative profile of Eldon cherty silt loam, 5 to 10 percent slopes, in a pasture, 720 feet north and 30 feet east of the southwest corner of sec. 4, T. 40 N., R. 25 W.:

A1—0 to 11 inches, very dark brown (10YR 2/2) cherty silt loam; strong, fine, granular structure; very friable; about 25 percent chert fragments; neutral; clear, smooth boundary.

A3—11 to 17 inches, dark-brown (10YR 3/3) cherty silt loam; moderate, fine, granular structure; friable; about 25 percent chert fragments; very strongly acid; clear, smooth boundary.

B21t—17 to 24 inches, dark-brown (7.5YR 4/4) very cherty silty clay loam; moderate, very fine, subangular blocky structure; about 60 percent chert fragments; firm; very strongly acid; clear, wavy boundary.

B22t—24 to 32 inches, mottled, yellowish-brown (10YR 5/4) and red (2.5YR 4/6) cherty clay; moderate, fine, subangular blocky structure; very firm; about 50 percent chert fragments; extremely acid; gradual, irregular boundary.

B23t—32 to 42 inches, mottled, yellowish-brown (10YR 5/4), very pale brown (10YR 7/4) and red (2.5YR 4/6) clay; weak, medium, subangular blocky structure; very firm; about 20 percent chert fragments; very strongly acid; gradual, irregular boundary.

B3t—42 to 62 inches, mottled, red (2.5YR 4/6) and very pale brown (10YR 7/4) cherty clay; massive; very firm; about 50 percent chert fragments; medium acid.

The A horizon ranges from 10 to 20 inches in thickness and in local areas is relatively free of chert. Depth to cherty material ranges from 0 to 15 inches. The A horizon is neutral to very strongly acid. Color of the cherty clay B2 horizon ranges from red (2.5YR 4/6) to very pale brown (10YR 7/4). The B3 horizon is quite variable and in places consists of alternate bands of white, dense chert 10 to 20 inches thick and relatively thin layers of mottled red and yellowish-brown clay. Fragmental limestone is at a depth of 5 to 10 feet or more. The C horizon ranges from medium acid to neutral.

Eldon soils are near Creldon soils but lack the fragipan of Creldon soils.

Eldon cherty silt loam, 2 to 5 percent slopes (EIB).—This soil is on ridgetops that extend into areas of the more steeply sloping Goss soils. Areas are 3 to 10 acres in size, are generally narrow, and occur along the ridge.

This soil has a profile similar to that described as representative for the series, but the surface layer contains fewer chert fragments.

Included with this soil in mapping are small areas of soils on the ends of the ridge points where the color of the surface layer is lighter because of the past encroachment of timber. Also included are minor areas on the broader ridges where the Eldon soils merge with the Hartwell and Deepwater soils that have a surface layer relatively free of chert and a clayey subsoil.

This soil is well suited to tillage, although it has a

cherty surface layer. Available water capacity is low, and natural fertility is medium. Runoff is medium. The major limitations to the use of this soil are susceptibility to erosion and droughtiness.

Small grain, hay, and pasture are the principal crops. Capability unit IIIs–6.

Eldon cherty silt loam, 5 to 10 percent slopes (EIC).—This soil is on the upper parts of the side slopes and at the head of drainageways. Areas are elongated and are parallel to the drainage channels, generally between the gently sloping soils upslope and the strongly sloping to moderately steep soils downslope. Areas of this soil are fairly uniform.

This soil has the profile described as representative for the series.

Included with this soil in mapping are small spots of less sloping soils on the top of the narrow ridges and some areas of sharply breaking, steeper soils.

Available water capacity is low, and natural fertility is medium. Runoff is rapid. The major limitations to the use of this soil are susceptibility to erosion and droughtiness.

This soil is used mainly for small grain, hay, and pasture. Capability unit IIIs–6.

Eldon cherty silt loam, 10 to 20 percent slopes (EID).—This soil is on sharply breaking side slopes below less sloping Eldon soils and above steeper Goss soils. Areas are irregular in size and shape and therefore are not well suited to cultivation. Areas range from 10 to 30 acres in size.

This soil has a profile similar to that described as representative for the series, but the surface layer ranges from 8 to 12 inches in thickness and the content of chert is slightly higher.

Included with this soil in mapping are a few small areas of less sloping Eldon soils.

Available water capacity is low, and natural fertility is medium. Runoff is rapid. The main limitations to the use of this soil are susceptibility to erosion and droughtiness.

This soil is mostly in grass cover and is better suited to grass than to most other uses. Capability unit VIs–6.

Gasconade Series

The Gasconade series consists of shallow, somewhat excessively drained, strongly sloping to steep soils on dissected uplands. These soils formed in residuum weathered from limestone. The native vegetation is prairie grasses and some cedar and oak trees.

In a representative profile the surface layer is very dark brown flaggy clay loam about 7 inches thick. The subsoil is dark-brown, very firm, flaggy clay about 7 inches thick. The underlying material is limestone bedrock.

Permeability is moderately slow, available water capacity is very low, and content of organic matter is high. Natural fertility is low. Runoff is very rapid.

Most areas of these soils are in scattered timber and grass cover.

Gasconade soils are mapped only in a complex with Rock land.

Representative profile of Gasconade flaggy clay loam, in an area of Rock land-Gasconade complex, 12 to 50 percent slopes, in a wooded area under a cover of oak and cedar trees, 240 feet east and 450 feet north of the southwest corner of NW¼ sec. 26, T. 40 N., R. 24 W.:

A1—0 to 7 inches, very dark brown (10YR 2/2) flaggy clay loam; moderate, fine, granular structure; firm; about 20 percent limestone fragments 1 to 3 inches in diameter; about 10 percent of surface is covered with stones; neutral; clear, smooth boundary.

B—7 to 14 inches, dark-brown (7.5YR 3/2) flaggy clay; moderate, medium, subangular blocky structure; very firm; soft; about 60 percent limestone flags 2 to 4 inches thick and chert fragments; mildly alkaline; clear, irregular boundary.

R—14 to 20 inches, limestone bedrock with weathered cracks, and partings containing clayey materials in the upper part.

The A horizon is silty clay, clay, stony silty clay, or stony clay. Colors range from black (10YR 2/1) to very dark grayish brown (10YR 3/2). The B horizon is dominantly flaggy clay or flaggy silty clay but ranges to flaggy heavy clay loam in some places. Color of the B horizon ranges from dark brown (7.5YR 3/2) to olive brown (2.5Y 4/4). Reaction is mildly alkaline to slightly acid. Limestone bedrock is at a depth of about 9 to 20 inches.

Gasconade soils are near Goss soils. They have a darker colored A horizon and a thinner solum than Goss soils, and they lack the thick B horizon common to Goss soils.

Goss Series

The Goss series consists of deep, well-drained, gently sloping to steep soils on highly dissected uplands in the forested part of the county. These soils occur where rocks of the Mississippian geologic system are exposed on the surface, generally at lower elevations than the Pennsylvanian materials that outcrop throughout most of the county. They formed in residuum from cherty limestone. The native vegetation is upland hardwoods.

In a representative profile the surface layer is very dark brown cherty silt loam about 4 inches thick. The subsurface layer is brown cherty silt loam about 7 inches thick. The firm subsoil is about 53 inches thick. The upper part is reddish-brown cherty silt loam, the middle part is reddish-brown cherty silty clay loam, and the lower part is reddish-brown and dark-brown cherty clay. The underlying material is weathered soft and hard limestone.

Permeability is moderate, available water capacity is low, and content of organic matter is moderate. Natural fertility is medium, and runoff is medium to rapid. The major limitations to use of these soils are susceptibility to erosion and droughtiness.

Most areas of these soils remain wooded.

Representative profile of Goss cherty silt loam, 15 to 50 percent slopes, in hardwood timber, 300 feet east and 30 feet north of the southwest corner of sec. 35, T. 42 N., R. 24 W.:

A1—0 to 4 inches, very dark brown (10YR 2/2) cherty silt loam; weak, fine, granular structure; very friable; about 15 percent chert fragments; strongly acid; clear, smooth boundary.

A2—4 to 11 inches, brown (7.5YR 5/4) cherty silt loam; weak, fine, granular structure; very friable; about

35 percent chert fragments; medium acid; clear, smooth boundary.

B1—11 to 23 inches, reddish-brown (5YR 5/4) cherty silt loam; weak, fine, subangular blocky structure; firm; about 35 percent chert fragments; strongly acid; gradual, smooth boundary.

B21t—23 to 27 inches, reddish-brown (5YR 5/4) cherty silty clay loam; weak, fine, subangular blocky structure; firm; about 50 percent chert fragments; strongly acid; gradual, smooth boundary.

B22t—27 to 35 inches, mottled reddish-brown (5YR 4/4) and dark-brown (7.5YR 4/4) cherty clay; weak, fine, subangular blocky structure; firm; about 50 percent chert fragments; few, soft, black concretions; strongly acid; gradual, wavy boundary.

B23t—35 to 48 inches, mottled dark-brown (7.5YR 4/4) and light yellowish-brown (10YR 6/4) cherty clay; moderate, medium, subangular blocky structure; firm; about 30 percent chert fragments; strongly acid; clear, smooth boundary.

B24t—48 to 64 inches, mottled dark-brown (7.5YR 4/4) and light yellowish-brown (10YR 6/4) cherty clay; weak, fine, subangular blocky structure; firm; about 45 percent chert and limestone fragments; medium acid; clear, smooth boundary.

C—64 to 69 inches, weathered soft and hard limestone.

The content of chert in the A horizon ranges from scattered fragments to as much as 50 percent, and size ranges from less than 1 inch to 10 inches or more but is dominantly about 2 inches. Below a depth of 27 inches, the dominant size of chert is as much as 8 inches. Local variations in colors of gray and red are common below a depth of 35 inches. Depth to relatively unweathered limestone ranges from 4 to 8 feet or more.

Goss soils are near Crider soils. They have more chert throughout and more clay in the B horizon than Crider soils.

Goss cherty silt loam, 2 to 15 percent slopes (GoC).—This soil is gently sloping on narrow ridges and strongly sloping on side slopes, mainly in the area where Mississippian surface geology dominates. Areas are irregularly shaped, are 5 acres to more than 30 acres in size, and generally are elongated and parallel to the drainageways.

This soil has a profile similar to that described as representative for the series, but it commonly has less chert in the surface layer, particularly in the less sloping areas. In some areas bedrock is at a depth of less than 5 feet.

Included with this soil in mapping are small areas of Crider soils that have a thicker mantle of silty material over the cherty residuum. These areas are on the broader ridges and on the more gentle slopes.

The cherty surface interferes with tillage and mowing. Available water capacity is low, and natural fertility is medium. Runoff is medium to rapid. The major limitations to the use of this soil are susceptibility to erosion and droughtiness.

This soil is suited to limited cropping. Small grain, grasses, and legumes are the most suitable crops. Control of erosion is a necessary part of good management. Capability unit IVs–9.

Goss cherty silt loam, 15 to 50 percent slopes (GoD).—This soil is on side slopes. It occupies only about 2 percent of the county, but it is significant because it occurs with other Goss soils in one rather large, continuous area. Areas are irregular in shape, are elongated, and are parallel to the drainageways. They range from 10 acres to several hundred acres in size.

This soil has the profile decribed as representative for the series. In some areas bedrock is at a depth of less than 5 feet.

Included with this soil in mapping are small areas of Rock land and of Gasconade soils and some intermingled areas of Goss cherty silt loam, 2 to 15 percent slopes. The areas of Rock land occur as nearly perpendicular bluffs. The less sloping Goss soil is on ridge divides and bench slopes.

Available water capacity is low, and natural fertility is medium. Runoff is rapid. This soil is susceptible to erosion.

This soil is unsuited to crops because of steepness of slope and chert content. It is used mainly for pasture or timber. Capability unit VIIs–9.

Hartwell Series

The Hartwell series consists of deep, somewhat poorly drained, nearly level to gently sloping soils on broad upland divides. These soils formed in loess and silty and shaly materials. The native vegetation is tall prairie grasses.

In a representative profile the surface layer is very dark grayish brown silt loam about 10 inches thick. The subsurface layer is grayish brown silt loam about 5 inches thick. The subsoil is about 27 inches thick. The upper part of the subsoil is very dark grayish-brown and grayish-brown, very firm clay, and the lower part is grayish brown and pale-brown, firm and very firm silty clay loam. The underlying material is very pale brown, brownish-yellow, and light brownish-gray silt loam.

Permeability is slow, available water capacity is moderate, and content of organic matter is moderate to high. Natural fertility is medium, and runoff is slow to medium. A perched water table is on top of the very firm clay subsoil in wet seasons. The major limitations to the use of these soils are wetness in spring, droughtiness in summer, and susceptibility to erosion.

Many areas of these soils are used for row crops. A large acreage is used for hay and pasture.

Representative profile of Hartwell silt loam, 0 to 2 percent slopes, 230 feet south and 430 feet west of the northeast corner of sec. 32, T. 41 N., R. 26 W.:

A1—0 to 10 inches, very dark grayish-brown (10YR 3/2) silt loam; weak, fine, granular structure; very friable; common roots; medium acid; abrupt, smooth boundary.

A2—10 to 15 inches, grayish-brown (10YR 5/2) silt loam; weak, fine, granular structure; very friable; common roots; medium acid; abrupt, smooth boundary.

B21t—15 to 22 inches, very dark grayish-brown (10YR 3/2) clay; few, fine, prominent, red (2.5YR 4/6) mottles;) moderate, fine, subangular blocky structure; very firm; few roots; common small concretions; patchy clay films on ped surfaces; medium acid; clear, smooth boundary.

B22t—22 to 28 inches, grayish-brown (10YR 5/2) and yellowish-brown (10YR 5/6) clay; few, fine, distinct, red (2.5YR 4/6) mottles; weak, medium, subangular blocky structure; very firm; many fine concretions; patchy dark-gray (10YR 4/1) clay films on ped surfaces; medium acid; clear, smooth boundary.

B31t—28 to 33 inches, mottled grayish-brown (10YR 5/2), pale-brown (10YR 6/3), and brownish-yellow (10YR 6/6) silty clay loam; weak, coarse, angular blocky structure; very firm; many small concretions; dark-gray (10YR 4/1) clay coatings on cleavage faces; neutral; clear, smooth boundary.

B32t—33 to 42 inches, pale-brown (10YR 6/3) silty clay loam; many, medium, distinct (30 percent by volume), very pale brown (10YR 7/4) mottles and (20 percent by volume) brownish-yellow (10YR 6/8) mottles; weak, coarse, blocky structure; firm; dark-gray (10YR 4/1) clay coatings in root channels and on ped surfaces; many dark concretions; neutral; clear, smooth boundary.

C—42 to 60 inches, mottled very pale brown (10YR 7/4), brownish-yellow (10YR 6/8), and light brownish-gray (10YR 6/2) silt loam; weak, coarse, subangular blocky structure; firm; few shale fragments; neutral.

The A1 horizon ranges from black (10YR 2/1) to very dark grayish brown (10YR 3/2) in color and from 8 to 13 inches in thickness. The A2 horizon ranges from dark gray (10YR 4/1) to grayish brown (10YR 5/2). The A2 horizon is more prominent in nearly level soils. In some places the B22 horizon rests on partially decomposed shale, but a depth of 8 feet or more to the weathered shale is most common. A concentration of gravel appearing as an indistinct lag gravel line at the shale contact is present in some areas. This may indicate some water reworking of the shale materials. In some areas chert fragments are in the B3 and C horizons.

Hartwell soils are near Deepwater soils. They differ from Deepwater soils in having an A2 horizon, an abrupt boundary between the A and B horizons, and a grayer B horizon.

Hartwell silt loam, 0 to 2 percent slopes (HtA).—This soil is at the top of wide divides and broad benches. Areas are 100 acres to more than 160 acres in size and are relatively uniform.

This Hartwell soil has the profile described as representative for the series.

Included with this soil in mapping are small areas, generally on long, narrow points, of Deepwater and Barco soils. Also included are a few areas of soils where the surface layer is about 17 inches thick and other areas where it is only about 9 inches thick. The thinner surface layer commonly occurs in the center of the broader and flatter mapped areas and does not appear to be the result of erosion.

Available water capacity is moderate, and content of organic matter is high. Natural fertility is medium, and runoff is slow. This soil tends to remain wet in spring and fall, and this often delays planting and harvesting. Droughtiness during the midsummer dry period is also a limitation.

This soil is well suited to cultivation. Most of it is cultivated and is used mainly for row crops. The soil is suited to corn, soybeans, sorghum, small grain, grasses, and legumes and to less intensive uses. Capability unit IIw–2.

Hartwell silt loam, 2 to 4 percent slopes (HtB).—This soil is on the long side slopes and relatively narrow ridgetops of the divides and broad benches. Areas are about 10 acres to more than 80 acres in size. In some places this soil is at the head of drainageways and has more gullies than Hartwell silt loam, 0 to 2 percent slopes. Shale fragments commonly are in the lower part of the subsoil and in the underlying material. In the southeastern part of the county, chert fragments also occur in the lower horizons, particularly where slopes are more rolling. The surface layer rarely exceeds 15 inches in thickness and commonly is 10 to 15 inches thick.

Included with this soil in mapping are gently sloping Barco and Deepwater soils on mounds. These soils are mainly in the eastern part of the county, where the divides are of only moderate width.

Available water capacity is moderate. Natural fertility and runoff are medium. The major limitation to the use of this soil is susceptibility to erosion.

This soil is well suited to cultivation, and more than 90 percent of it is cropped regularly. It is suited to corn, soybeans, sorghum, small grain, grasses, and legumes and to less intensive uses. Capability unit IIe–6.

Hartwell silt loam, 2 to 5 percent slopes, eroded (HtB2).—This soil is on long side slopes and at the heads of drainageways of divides and benches. Areas are normally elongated, are parallel to the slope, and are 5 to 15 acres in size.

This soil has a profile similar to that described as representative for the series, but the surface layer is 6 to 12 inches thick. The subsurface layer commonly has been mixed with the surface layer by tillage, resulting in a lighter colored plow layer in much of the area. Shale fragments, and chert fragments in places, are quite evident in the lower part of the subsoil and in the underlying material.

Included with this soil in mapping are a few spots of gently sloping, eroded Barco and Deepwater soils.

Available water capacity is moderate, and runoff is medium. Natural fertility is medium. The major limitation to the use of this soil is susceptibility to erosion. The soil is droughty in summer, and nearly all plants are injured by lack of moisture.

This soil is well suited to cultivation, but eroded spots and occasional gullies make tillage and the layout and construction of terraces difficult. It is suited to small grain, grasses, and legumes and to less intensive uses. It is better suited to grasses and legumes for hay or pasture than to most other crops. Capabil-it yunit IIIe–6.

Hartwell silty clay loam, 2 to 5 percent slopes, severely eroded (HyB3).—This soil is on the upper side slopes of divides and benches. Areas normally are elongated and are parallel to the slope. They are fan shaped at the heads of drainageways. Gullies are common in such areas. Areas of this soil are generally less than 5 acres in size.

This soil has a profile similar to that described as representative for the series, but the surface layer consists of material from the original surface layer, subsurface layer, and subsoil. As a result, the plow layer is lighter in color, is silty clay loam, and is thinner than that of Hartwell silt loam, 0 to 2 percent slopes. Shale fragments and a few chert particles are common on the surface and throughout the profile.

Included with this soil in mapping are small areas of Barco, Deepwater, Eldon, and Roseland soils.

Available water capacity is moderate, and runoff is medium. Content of organic matter is moderate. The

major limitation to the use of this soil is susceptibility to erosion.

Areas of this soil are generally small and irregularly shaped and therefore are not well suited to cultivation. They are better suited to the establishment of grass cover for hay or pasture or as habitat for openland wildlife. Providing protection from runoff by use of terraces or diversions is a necessary part of good management. Capability unit IVe–8.

Lightning Series

The Lightning series consists of deep, poorly drained, nearly level soils on low terraces and flood plains along major streams. These soils formed in clayey alluvium. The native vegetation is tall grasses and deciduous trees.

In a representative profile the surface layer is dark grayish-brown silt loam about 8 inches thick. The subsurface layer is light brownish-gray silt loam about 4 inches thick. The subsoil is about 31 inches thick. The upper part of the subsoil is dark grayish-brown, firm silty clay loam, the middle part is dark-gray, very firm silty clay, and the lower part is dark grayish-brown and yellowish-brown, very firm silty clay. The underlying material is dark reddish-brown and yellowish-brown silty clay loam.

Permeability is very slow, available water capacity is high, and content of organic matter is moderate. Natural fertility is low, and runoff is slow to very slow. The major limitations to the use of these soils are wetness and occasional flooding.

Most areas of these soils are used for row crops. Small, narrow areas are used for hay and pasture.

Representative profile of Lightning silt loam in a lespedeza meadow, 300 feet north and 100 feet east of the southwest corner of NW¼ sec. 25, T. 43 N., R. 27 W.:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine, granular structure; friable; many manganese and iron concretions; neutral; gradual, smooth boundary.

A2—8 to 12 inches, light brownish-gray (10YR 6/2) silt loam; weak, medium, platy structure; very friable; many manganese and iron concretions; very strongly acid; gradual, smooth boundary.

B21t—12 to 17 inches, dark grayish-brown (10YR 4/2) silty clay loam; few, fine, faint, yellowish-brown (10YR 5/6) mottles; moderate, very fine, subangular blocky structure; firm; thin discontinuous clay films on ped surfaces and in root channels; common gray silt coatings on ped surfaces; many manganese and iron concretions; very strongly acid; gradual, smooth boundary.

B22t—17 to 24 inches, dark-gray (10YR 4/1) silty clay; common, medium, distinct, yellowish-brown (10YR 5/4) mottles; moderate, fine, sunbangular blocky structure; very firm; clay films on most ped surfaces; many iron and manganese concretions; very strongly acid; gradual, smooth boundary.

B23t—24 to 34 inches, dark-gray (10YR 4/1) silty clay; many, fine, distinct, brown (10YR 5/3) mottles; moderate, fine, subangular blocky structure; very firm; clay films on most ped surfaces; many iron and manganese concretions; very strongly acid; gradual, smooth boundary.

B3t—34 to 43 inches, mottled dark grayish-brown (10YR 4/2) and yellowish-brown (10YR 5/4) silty clay; weak, medium, subangular blocky structure; very firm; common manganese and iron concretions; very strongly acid; gradual, wavy boundary.

C—43 to 60 inches, coarsely mottled dark reddish-brown (2.5YR 2/4) and yellowish-brown (10YR 5/4) silty clay loam; massive; firm; common, coarse, soft manganese and iron concretions; medium acid.

The Ap horizon ranges from very dark grayish brown (10YR 3/2) to grayish brown (10YR 5/2) in color and from 7 to 10 inches in thickness. The Ap horizon normally is very strongly acid but ranges to neutral where applications of lime have been abnormally heavy. The B2 horizon ranges from silty clay loam to clay. Thickness of the zone of maximum clay ranges from 20 to 36 inches.

Lightning soils are near Osage soils on high bottom positions. They differ from the Osage soils in having an A2 horizon and a lighter colored A1 or Ap horizon and B horizon.

Lightning silt loam (Ls).—This soil occupies low stream terraces or high bottom positions along major streams. Slopes range from 0 to 2 percent. Areas are generally less than 20 acres in size and commonly occur at the junction of tributary streams and adjacent to tree-covered upland slopes.

Included with this soil in mapping in places are small depressions where the color of the surface layer is somewhat darker than that of this lightning soil. Also included are some areas where slope is 3 to 5 percent and the terrace escarpment joins the adjacent alluvial areas.

This soil has a friable surface layer. It has a tendency to remain wet in wet seasons and to dry out rapidly and be droughty in dry seasons. Natural fertility is low.

This soil is well suited to tillage. It is suited to soybeans, small grain, and fescue. It is not suited to alfalfa. Capability unit IIIw–2.

Mandeville Series

The Mandeville series consists of moderately deep, well-drained, gently sloping to moderately steep soils on rounded ridgetops and convex side slopes. These soils formed in silty material, mostly residuum weathered from acid silty shale. The native vegetation is deciduous forests.

In a representative profile the surface layer is dark grayish-brown silt loam about 5 inches thick. The subsurface layer is yellowish-brown silt loam about 3 inches thick. The subsoil is 28 inches thick. The upper part of the subsoil is brown and dark yellowish-brown friable silt loam, the middle part is yellowish-brown firm silt loam, and the lower part is yellowish-brown and light brownish-gray firm loam. The underlying material is dark yellowish-brown and gray soft shale.

Permeability is moderate, available water capacity is moderate, and content of organic matter is low. Natural fertility is medium, and runoff is medium to very rapid. The major limitation to use of these soils is susceptibility to erosion.

Most areas of these soils are used for pasture and hay crops. Some areas are used for corn, soybeans, and small grain, and other areas remain wooded.

Representative profile of Mandeville silt loam, 5 to 10 per cent slopes, eroded, in grass cover, 100 feet east

and 100 feet north of the southwest corner of SE¼NW¼ sec. 17, T. 43 N., R. 26 W.:

A1—0 to 5 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine, granular structure; friable; slightly acid; clear, smooth boundary.

A2—5 to 8 inches, yellowish-brown (10YR 5/4) silt loam; weak, fine, granular structure; friable; slightly acid; clear, smooth boundary.

B1—8 to 12 inches, brown (10YR 4/3) heavy silt loam; moderate, medium, subangular blocky structure; friable; medium acid; clear, smooth boundary.

B2t—12 to 20 inches, dark yellowish-brown (10YR 4/4) heavy silt loam; weak, medium, blocky structure; friable; thin patchy clay films; yellowish-brown (10YR 5/8) fragments of weathered shale; medium acid; clear, smooth boundary.

B31t—20 to 26 inches, yellowish-brown (10YR 5/4) heavy silt loam; weak, medium, blocky structure; firm; many, platelike, strong-brown (7.5YR 5/6) shale fragments; patchy clay films; strongly acid; clear, smooth boundary.

B32t—26 to 36 inches, mottled yellowish-brown (10YR 5/4) and light brownish-gray (10YR 6/2) loam; weak, medium, blocky structure; firm; many shale fragments coated with black stains; dark-brown (7.5YR 4/4) clay films on ped surfaces; strongly acid; clear, smooth boundary.

C—36 to 60 inches, dark yellowish-brown (10YR 4/4) and gray (10YR 6/1), acid, soft, micaceous shale; easily dug with spade.

The solum ranges from 20 to 40 inches in thickness. The A1 horizon ranges from dark grayish brown (10YR 4/2) to brown (10YR 5/3). The B horizon ranges from silt loam to loam and light clay loam. Shale fragments are common throughout the profile.

Mandeville soils are near Roseland and Bolivar soils. They have a thicker solum than Roseland soils. Mandeville soils have less sand throughout and less red hues than Bolivar soils.

Mandeville silt loam, 2 to 5 percent slopes (MaB).—This soil is on rounded ridgetops and upper side slopes. It occurs between areas of more sloping Mandeville soils in elongated, narrow areas on ridgetops. Areas are generally less than 5 acres in size and are commonly farmed with other soils.

This soil has a profile similar to that described as representative for the series, but the surface layer normally is about 8 inches thick and the surface and subsurface layers combined are 10 to 12 inches thick. Fewer shale fragments are in the upper part of the subsoil.

Included with this soil in mapping are small areas of soils that have shale bedrock at a depth of 40 to 45 inches. Also included are small areas that are steeper.

This soil is friable and is easily worked. Available water capacity is moderate, and content of organic matter is low. Natural fertility and runoff are medium. The main limitation to the use of this soil is susceptibility to erosion.

The soil is well suited to tillage. It is well suited to most crops grown in the area, including alfalfa. Capability unit IIe–4.

Mandeville silt loam, 5 to 10 percent slopes, eroded (MaC2).—This soil has complex slopes that generally are convex at the upper one-third to concave at the lower one-third. It is commonly dissected by drainageways, particularly in areas at the head of small watersheds. It normally occurs between less sloping Mandeville soils at higher elevations and more sloping Mandeville or Norris soils at lower elevations.

This soil has the profile described as representative for the series.

Included with this soil in mapping are areas of soils that have a darker colored surface layer that has been influenced by colluvium along the drainage channels. Also included are areas of soils that have a brown surface layer and some areas that have a subsoil of clay loam, particularly where the depth to the parent shale is less than that in this Mandeville soil.

The soil is friable and easily worked. Available water capacity is moderate. Natural fertility is medium, and runoff is rapid. Alfafa and other crops common to the area are well suited to this soil. The major limitation to the use of this soil is susceptibility to erosion. Capability unit IVe–7.

Mandeville silt loam, 10 to 25 percent slopes (MaD).—This soil is on uplands. Rock or shale outcroppings are common, particularly at the base of slopes. Some areas of this soil occur at the base of steeper slopes.

This soil has a profile similar to that described as representative for the series, but the surface layer and subsoil are somewhat thinner to shale bedrock.

Available water capacity is moderate. Natural fertility is medium, and runoff is very rapid. The major limitation to the use of this soil is susceptibility to erosion.

This soil is well suited to pasture or woodland. It is unsuited to cultivation, because of steepness and shape of slope. Control of erosion is a necessary part of good management. Capability unit VIe–7.

Mine Pits and Dumps

Mine pits and dumps (Mp) consists of areas in which surface mining has left exposed on the surface a mixture of shale, sandstone, limestone, and the original mantle of soil. This land type is extensive, and its extent increases as mining continues. The larger areas are more than 2,000 acres in size and generally are long and narrow. Abandoned pits commonly are filled with water.

Natural fertility in the mined areas is low. These areas are poorly drained to excessively drained. Air and water movement generally is slow, and runoff generally is rapid.

Steep slopes, the texture and thickness of the surface layer, and the hazard of erosion generally make tillage impractical. Response to management is low. The use of this land type is restricted largely to wildlife habitat, pasture, or trees. Good management is essential for sustained use. Capability unit VIIe–7.

Muldrow Series

The Muldrow series consists of deep, somewhat poorly drained, nearly level soils on flood plains and slightly concave low stream terraces. These soils formed in clayey alluvium. The native vegetation is mixed hardwoods and an understory of tall grasses.

In a representative profile the surface layer is silt loam about 14 inches thick. The upper part is very dark gray, and the lower part is black. The subsoil is

firm silty clay loam that extends to a depth of more than 60 inches. The upper part of the subsoil is black, and the lower part is mottled dark grayish brown, dark gray, and brown.

Permeability is very slow, available water capacity is very high, and content of organic matter is high. Natural fertility is high, and runoff is slow. The major limitations to use of these soils are wetness and occasional flooding.

Most areas of these soils are used for cultivated crops of soybeans and small grain. A lesser acreage is used for corn, grain sorghum, and alfalfa. A small acreage remains wooded.

Representative profile of Muldrow silt loam in a cultivated field, 920 feet north and 350 feet east of the southwest corner of NW1/4 sec. 17, T. 42 N., R. 28 W.:

Ap—0 to 7 inches, very dark gray (10YR 3/1) silt loam, dark gray (10YR 4/1) when dry, very dark grayish brown (10YR 3/2) when crushed; moderate, fine, granular structure; friable; slightly acid; clear, smooth boundary.

A12—7 to 14 inches, black (10YR 2/1) silt loam, dark gray (10YR 4/1) when dry, very dark grayish brown (10YR 3/2) when crushed; moderate, very fine, angular blocky structure; firm; slightly acid; clear, smooth boundary.

B1—14 to 21 inches, black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) when dry, very dark gray (10YR 3/1) when crushed; moderate, fine, subangular blocky structure; firm; many, small, dark concretions; slightly acid; clear, smooth boundary.

B21t—21 to 28 inches, black (10YR 2/1) heavy silty clay loam, dark gray (10YR 4/1) when dry; moderate to strong, medium, angular blocky structure; firm; few, fine, distinct, dusky-red (2.5YR 3/2) iron stains; many, moderatley large, dark concretions; thin discontinuous clay films on ped surfaces that increase with depth; neutral; clear, smooth boundary.

B22t—28 to 36 inches, black (10YR 2/1) and very dark gray (10YR 3/1) heavy silty clay loam; common, fine, distinct, very dark grayish-brown (2.5Y 3/2) mottles; moderate, medium, subangular blocky structure; firm; discontinuous clay films on ped surfaces that increase with depth; neutral; clear, smooth boundary.

B31t—36 to 46 inches, mottled dark grayish-brown (2.5Y 4/2) and dark-gray (10YR 4/1) heavy silty clay loam; weak, medium to fine, subangular blocky structure; firm; thin, discontinuous, black (10YR 2/1) clay films on ped surfaces; neutral; clear, smooth boundary.

B32t—46 to 60 inches, mottled dark-gray (10YR 4/1) and brown (10YR 4/3) heavy silty clay loam; weak, fine, subangular blocky structure; firm; thin, discontinuous, black (10YR 2/1) clay films on ped surfaces; neutral.

The A horizon ranges from black (10YR 2/1) to very dark grayish brown (10YR 3/2) in color and from 10 to 20 inches in thickness. Reaction is slightly acid in the upper part and neutral in the lower part.

Muldrow soils occur in similar position and are near Osage, Quarles, Urich, and Verdigris soils. They have a thicker, darker A horizon, are less acid in the lower part, and are higher in phosphate than Urich soils. Muldrow soils have a much thicker dark surface layer, are lower in content of clay, and lack the A2 horizon of Quarles soils. Muldrow soils have an increase in clay content with depth, whereas Verdigris and Osage soils do not, and they are coarser textured than Osage soils.

Muldrow silt loam (Mu).—This soil is in the small creek bottoms and near uplands on larger bottoms in the prairie sections of the county. Slopes are less than 1 percent. Areas are normally elongated and narrow and are commonly cut by meandering stream channels. They are subject to occasional flash flooding.

Included with this soil in mapping are a few areas of soils that have a very dark grayish-brown surface layer and a dark grayish-brown subsoil. These browner colors normally occur at the undulating edge of soil areas near stream channels. The surface layer is silty clay loam and the subsoil is silty clay in some localized areas in depressions adjacent to uplands. Also included are areas of Quarles and Osage soils that make up as much as 10 per cent of the total acreage.

The major limitation to the use of this soil is excessive wetness caused by slow runoff, slow drainage, and occasional flooding.

This soil is friable and is well suited to cultivation, but fields are somewhat small and of irregular shape because of meandering stream channels. It is suited to soybeans, corn, sorghum, small grain, grasses, and legumes. It is also suited to woodland. Capability unit IIw-1.

Newtonia Series

The Newtonia series consists of deep, well-drained, nearly level to gently sloping soils on uplands. These soils formed in limestone residuum. The native vegetation is tall grasses.

In a representative profile the surface layer is very dark brown silt loam about 14 inches thick. The subsoil extends to a depth of more than 60 inches. The upper part of the subsoil is very dark grayish-brown friable silty clay loam, the middle part is brown and yellowish-red firm silty clay, and the lower part is yellowish-red and red firm clay.

Permeability is moderate, available water capacity is high, and content of organic matter is high. Natural fertility is high, and runoff is slow to medium. The major limitation to the use of these soils is susceptibility to erosion.

Most areas of these soils are used for cultivated crops. A small acreage is used for tame pasture, grasses, and alfalfa. The common crops are corn, sorghum, and soybeans.

Representative profile of Newtonia silt loam, 1 to 3 per cent slopes, in a bluegrass pasture 200 feet west and 1,270 feet north of the middle of sec. 27, T. 43 N., R. 24 W.:

A1—0 to 14 inches, very dark brown (10YR 2/2) silt loam; moderate, fine, granular structure; friable; medium acid; gradual, smooth boundary.

B1—14 to 24 inches, very dark grayish-brown (10YR 3/2) silty clay loam; moderate, fine, subangular blocky structure; few small manganese concretions; friable; strongly acid; gradual, smooth boundry.

B21t—24 to 29 inches, brown (7.5YR 4/4) silty clay; strong, fine, blocky structure; firm; continuous, dark-brown (7.5YR 3/2) clay films; gradual, smooth boundary.

B22t—29 to 37 inches, yellowish-red (5YR 4/6) silty clay; strong, fine, blocky structure; firm, continuous, dark-brown (7.5YR 3/2) clay films; few manganese concretions and stains; medium acid; gradual, smooth boundary.

B23t—37 to 44 inches, yellowish-red (5YR 4/6) clay; many, medium, distinct, dark-brown (10YR 4/3) mottles; strong, medium, blocky structure; firm; continuous clay films on ped surfaces; few black manganese stains; medium acid; gradual, smooth boundary.

B3—44 to 60 inches, red (2.5YR 4/6) clay; weak, medium, subangular blocky structure; firm; few manganese concretions and dark stains; medium acid.

The A1 horizon, or Ap horizon, ranges from dark reddish brown (5YR 3/3) to very dark brown (10YR 2/2). It ranges from slightly acid to strongly acid in reaction and from 10 to 18 inches in thickness. The A horizon contains a few fragments of chert. The B horizon ranges from slightly acid to strongly acid. The B1 horizon ranges from very dark grayish brown (10YR 5/2) to yellowish red (5YR 5/6). This layer has a mottled appearance because of worm activity. The B2t horizon ranges from reddish brown (5YR 5/3) to dark red (2.5YR 3/6). Dominant red colors are present in the B3 horizon. In some places the lower part of the B2t horizon and the B3t horizon are heavy silty clay loam.

This soil has finer texture and yellower hue in the B21t horizon than is defined as within the range for the Newtonia series, but this difference does not alter the usefulness or behavior of the soils.

Newtonia soils are near Creldon, Deepwater, and Summit soils. They are redder in the A and B horizons than all of these soils. Newtonia soils lack the fragipan that is present in Creldon soils.

Newtonia silt loam, 1 to 3 percent slopes (NeB).—This soil is on ridgetops above the more sloping Deepwater, Snead, and Summit soils and the Rock land-Gasconade complex, 12 to 50 percent slopes, in most parts of the county. Areas are 5 to 15 acres or larger in size.

Included with this soil in mapping are a few small areas of Crider, Deepwater, Goss, Snead, and Summit soils that make up less than 10 percent of the total acreage. Also included are areas of soils that have slopes of 2 to 5 percent near the slope breaks at the heads of drainageways. These areas are thinner and browner than this Newtonia soil because of erosion.

Natural fertility is high, and runoff is slow to medium. The major limitation to the use of this soil is slight susceptibility to erosion.

This soil is well suited to all crops grown in the county. It is very well suited to alfalfa, and it is well suited to grasses, legumes, and trees. Capability unit IIe–1.

Norris Series

The Norris series consists of shallow, well-drained, strongly sloping to steep soils on uplands. These soils formed in residuum from acid shale. The native vegetation is deciduous hardwoods, mainly white oak, black oak, shingle oak, and hickory.

In a representative profile the surface layer is very dark grayish-brown shaly loam about 2 inches thick. The subsoil is brown shaly loam about 9 inches thick. The underlying material is light yellowish-brown soft shale.

Permeability is moderate, available water capacity is very low, and content of organic matter is moderate. Natural fertility is low. Runoff is rapid to very rapid.

Most areas of these soils are in mixed grasses and trees.

Representative profile of Norris shaly loam, 10 to 25 percent slopes, in a hardwood forest, 450 feet south and 50 feet east of the northwest corner of sec. 9, T. 43 N., R. 26 W.:

A1—0 to 2 inches, very dark grayish-brown (10YR 3/2) shaly loam, grayish brown (10YR 5/2) when dry; moderate, fine, granular structure; very friable; many, hard, sandy shale fragments; strongly acid; clear, smooth boundary.

B—2 to 11 inches, brown (10YR 4/3) shaly loam; pale brown (10YR 6/3) when dry; weak, fine, granular structure; very friable; many, hard, sandy shale fragments in the lower part; strongly acid; gradual, wavy boundary.

C—11 to 60 inches, light yellowish-brown (10YR 6/4), thin-bedded, soft, micaceous shales that show brown and red weathered edges and are partially decomposed; easily dug with hand spade; very strongly acid.

Depth to underlying shale ranges from 10 to 20 inches. Reaction throughout the profile is strongly acid to very strongly acid. The underlying shale ranges from hard and sandy to soft and silty. The A1 horizon ranges from very dark grayish brown (10YR 3/2) to brown (10YR 4/3). Texture ranges from very fine sandy loam to silt loam and shaly loam. The B horizon ranges from dark grayish brown (10YR 4/2) to yellowish brown (10YR 5/4) and light olive brown (2.5YR 5/4) in color and from shaly loam to silt loam in texture.

Norris soils are near Mandeville and Coweta soils and the Rock land-Gasconade complex. They have a thinner B horizon than Mandeville soils and a thinner A horizon than Coweta and Gasconade soils.

Norris shaly loam, 10 to 25 percent slopes, eroded (NoD2).—This soil is on uplands. The surface layer is thin, and acid and micaceous shale is at or near the surface. It most commonly occurs near Bolivar and Mandeville soils.

Included with this soil in mapping are areas of eroded Mandeville soils that make up as much as 15 percent of the total acreage. Also included are some areas of Norris soils that have slopes of less than 10 percent or more than 25 percent. There are some areas of soils in which depth to shale is less than 10 inches or more than 20 inches. In some places sandstone or limestone rocks are in the profile or outcrop on the surface.

Available water capacity is very low, runoff is rapid to very rapid, and natural fertility is low.

This soil is commonly idle or is in poor-quality grass or trees. Cultivation is not generally practical, because of the thin soil mantle or steep slopes. This soil is mainly suited to grass or trees, but the choice of species is limited. Capability unit VIIs–8.

Osage Series

The Osage series consists of deep, poorly drained, nearly level soils on low terraces and along major streams. These soils formed in clayey alluvium. The native vegetation is deciduous forest and an understory of grasses.

In a representative profile the surface layer is black and very dark gray and is about 32 inches thick. The upper part is silty clay loam, and the lower part is silty clay. The subsoil is very firm very dark gray silty clay that extends to a depth of more than 60 inches.

Permeability is very slow, available water capacity is moderate, and content of organic matter is high. Natural fertility is high, and runoff is slow to very slow. The major limitations to the use of these soils are wetness and occasional flooding.

Most areas of these soils are used for corn and soybeans. Some small areas remain wooded.

Representative profile of Osage silty clay loam in a cultivated field in a wide bottom, 770 feet south and 350 feet west of the northeast corner of sec. 18, T. 42 N., R. 28 W.:

Ap—0 to 6 inches, black (10YR 2/1) silty clay loam; moderate, fine, granular structure; firm; slightly acid; abrupt, smooth boundary.

A12—6 to 20 inches, very dark gray (10YR 3/1) silty clay loam; moderate, fine, subangular blocky structure; firm; few fine manganese concretions; medium acid; gradual, smooth boundary.

A13—20 to 32 inches, black (10YR 2/1) silty clay; moderate, fine, subangular blocky structure; firm; few fine manganese and iron concretions; medium acid; gradual, smooth boundary.

B21g—32 to 42 inches, very dark gray (10YR 3/1) silty clay; moderate, fine, subangular blocky structure; very firm; many brownish-yellow (10YR 6/6) and red (2.5YR 4/6) iron stains; few manganese concretions; medium acid; gradual, smooth boundary.

B22g—42 to 60 inches, very dark gray (10YR 3/1) silty clay; common, medium, distinct, light brownish-gray (10YR 6/2) mottles; moderate, fine, subangular blocky structure; very firm; red (2.5YR 4/6) iron stains; few manganese concretions; slightly acid.

The horizon ranges from black (10YR 2/1) to very dark grayish brown (10YR 3/2). Texture below a depth of 20 inches ranges from silty clay to heavy silty clay in some valleys, and color below a depth of 18 inches ranges from black (N 2/0) to very dark gray (10YR 3/1).

Osage soils are near Verdigris soils along stream channels. Osage soils have a blacker A horizon, grayer colors below the A horizon, and a finer texture throughout than Verdigris soils.

Osage silty clay loam (Os).—This soil is on bottom lands on the flood plains of the major streams of the country. It commonly is between the Osage silty clays along the bluffs and the Verdigris soils along stream channels. Slopes are less than 1 percent. Depending on the width on the stream valley, areas of this soil are as much as 60 to 100 acres in size.

This soil has the profile described as representative for the series.

Included with this soil in mapping are areas of soils that have a few inches of silty overwash and some depressional areas of soils that have a surface layer of silty clay. These included areas make up as much as 10 to 15 percent of the total acreage. Also included are small islands or points of the Quarles and Muldrow soils that make up as much as 10 percent of some areas.

Available water capacity and runoff are slow to very slow. Many low spots and depressions are in many areas. Some areas are without outlets. The soil is poorly drained, and seasonal wetness is a limitation to use.

This soil is well suited to cultivation but is subject to seasonal flooding. It is suited to soybeans, corn, sorghum, grasses, and legumes. Control of surface water is a necessary part of good management. Capability unit IIw–1.

Osage silty clay loam, high bottom (Ot).—This soil is on higher elevations of the flood plains of the major stream valleys. Slopes are less than 1 percent. Areas range from 3 to 10 acres in size and normally are in elongated areas parallel to the streams.

This soil has a profile similar to that described as representative for the series, but the surface layer is as thick as 20 inches in places. The subsoil ranges from silty clay to silty clay loam.

Included with this soil in mapping are small areas of Osage silty clay loam and of Quarles and Muldrow soils. These included soils rarely make up as much as 15 percent of any given area. This soil shrinks and crackes markedly during dry periods. It appears to have formed where a dark-colored, phosphatic and calcareous shale outcrop coincides with the bottom or terrace level.

Available water capacity is moderate, and runoff is slow to very slow.

This soil is well suited to cultivation but tends to be wet in spring and fall. It is suited to soybeans, corn, small grain, sorghum, grasses, and legumes. Capability unit IIw–1.

Osage silty clay (Oy).—This depressional soil is on bottoms on the flood plains of the major creeks and rivers. It normally occupies the low-lying parts of the bottoms between uplands and natural stream levees. Slopes are less than 1 percent. Areas range from about 3 acres to as much as 100 acres in size.

This soil has a profile similar to that described as representative for the series, but the surface layer is silty clay or clay and is 6 to 12 inches thick.

Included with this soil in mapping are small areas of Osage silty clay loam that make up as much as 15 percent of the total acreage.

This soil is poorly drained. Available water capacity is moderate. Standing water normally accumulates on areas of this soil for several days during the spring planting season. Many areas, because of inadequate outlets, are covered with smartweed and marsh grasses. Fence rows and turning areas are commonly weedy or are puddled from implement traffic.

Where drainage is adequate, this soil is well suited to soybeans, sorghum, and wheat. Capability unit IIIw–14.

Quarles Series

The Quarles series consists of deep, poorly drained, nearly level soils on stream terraces along major streams in the county. These soils formed in alluvium. The native vegetation is tall prairie grasses and some deciduous hardwoods.

In a representative profile the surface layer is very dark grayish-brown silt loam about 8 inches thick. The subsurface layer is gray silt loam about 10 inches thick. The subsoil is dark gray and extends to a depth of more than 60 inches. The upper part of the subsoil is firm silty clay loam, the middle part is very firm silty clay, and the lower part is firm silty clay loam.

Permeability is slow, available water capacity is high, and content of organic matter is moderate. Natural fertility is medium, and runoff is slow. The major limitation to the use of these soils is wetness.

Most areas of these soils are used for row crops, such as corn and soybeans. Some are used for hay and pasture. A few areas remain wooded.

Representative profile of Quarles silt loam in a cultivated field, 300 feet west and 200 feet north of the southeast corner of sec. 7, T. 43 N., R. 26 W.:

Ap—0 to 8 inches, very dark grayish-brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) when dry; moderate, fine, granular structure; friable; common fine roots; common dark-colored manganese and iron concretions; strongly acid; abrupt, smooth boundary.

A2g—8 to 18 inches, gray (10YR 5/1) silt loam, gray (10YR 6/1) when dry; weak, medium, platy structure; very friable; common fine roots; common dark manganese and iron concretions; very strongly acid; clear, smooth boundary.

B21tg—18 to 24 inches, dark-gray (10YR 4/1) silty clay loam; common, fine, distinct, yellowish-brown (10YR 5/6) mottles; moderate, fine, subangular blocky structure; firm; few fine roots; common dark-colored manganese and iron concretions; distinct clay films on ped surfaces; very strongly acid; gradual, smooth boundary.

B22tg—24 to 36 inches, dark-gray (10YR 4/1) silty clay; common, fine, distinct, yellowish-brown (10YR 5/6) mottles; moderate, medium, subangular blocky structure; very firm; common dark-colored manganese and iron concretions; distinct clay films on ped surfaces; strongly acid; gradual, smooth boundary.

B31tg—36 to 48 inches, mottled, dark-gray (10YR 4/1) and brown (10YR 4/3) silty clay loam; fine, distinct, yellowish-brown (10YR 5/6) mottles; weak, coarse, subangular blocky structure; firm; few dark-colored iron and manganese concretions; few discontinuous, very dark gray (10YR 3/1) clay films; medium acid; gradual, smooth boundary.

B32tg—48 to 62 inches, mottled, dark-gray (10YR 4/1), yellowish-brown (10YR 5/6), and strong-brown (7.5YR 5/6) silty clay loam; weak, fine, subangular blocky structure; firm; few discontinuous clay films; slightly acid.

The solum ranges from 36 inches to more than 60 inches in thickness. The A1 or Ap horizon ranges from black (10YR 2/1) to very dark grayish brown (10YR 3/2). The A horizon ranges from 15 to 24 inches in thickness. The B horizon ranges from silty clay loam to silty clay in texture and from very dark grayish brown (10YR 3/2) to light brownish gray (2.5Y 6/2) and strong brown (7.5YR 5/6) in color. The B2 horizon is very strongly acid to strongly acid.

Quarles soils are near Hartwell and Osage soils. They have a less abrupt change from the A2 horizon to the B horizon and have less clay in the B2 horizon than Hartwell soils. Quarles soils are more acid than Osage soils.

Quarles silt loam (Qu).—This soil is on stream terraces along the major streams of the county. Slopes are less than 1 percent. Areas of this soil are 1 to 3 acres or larger is size.

Included with this soil in mapping are small areas of Hartwell soils in places where long, low-lying upland points blend into the terrace levels. These areas make up as much as 5 percent of the total acreage. Also included are areas of Urich and Lightning soils in places where terrace and bottom land levels are cut by meandering channels, and differences in the soil profile are indistinct. These include soils make up as much as 10 percent of the total acreage.

The major limitation to the use of this soil is wetness caused by slow internal water movement. This limitation necessitates careful choice of crops, timely seasonal operations, and use of lime and fertilizer to achieve sustained crop growth.

This soil is well suited to tillage, but it occurs in small odd-shaped tracts. It is suited to soybeans, corn, sorghum, small grain, grasses, and legumes, and it is well suited to fescue. Capability unit IIw-1.

Rock Land

Rock land consists of gently sloping to steep outcrops and ledges of limestone and of floatstones, mostly of sandstone. This land type is mapped only in complexes with Bolivar and Gasconade soils in the highly dissected uplands along the major streams in all parts of the county.

In many places the soils in areas of Rock land have a profile similar to those described as representative for the Coweta and Norris series. In some areas the surface layer is medium textured and is underlain by plastic clay of varied colors. In small, gladelike areas black, clayey material is between ledges of limestone.

The water intake rate between the rocks and in the fractures is rapid, and internal drainage is rapid. Available water capacity is very low. Runoff ranges from medium to very rapid, depending on slope.

Only a few trees and a small amount of wild grasses grow on Rock land. The many ledges, floatstones, and bedrock outcrops make logging operations difficult.

Rock land-Gasconade complex, 12 to 50 percent slopes (RgD).—This complex is adjacent to major streams throughout the county. About two-thirds of the complex is Rock land, which is generally steeper than the Gasconade soil. About one-third of the complex is Gasconade flaggy clay loam, which commonly is sloping and occurs at higher elevations. The areas of Rock land and Gasconade soil are too intermingled to be mapped separately.

The Gasconade soil in this complex has a profile similar to that described as representative for the Gasconade series. In Rock land the rock content ranges from escarpments of 100 percent rock to as little as 20 percent rock. The rocks are limestone, chert, or mixtures of the two with lenses of shale. The surface layer includes textures of stony silt loam, loam, and clay loam.

Included with this complex in mapping are areas of colluvial and alluvial soils along the narrow valleys. These included soils have a thicker surface layer and fewer rocks.

Available water capacity is very low. Natural fertility is low. Stone content and steep slopes prevent tillage, and mowing is generally not feasible. Scattered trees cover most of this complex, but timber production is generally not feasible. This soil is better suited to range than to most other uses. Protection from overgrazing and burning is a necessary part of good management. Capability unit VIIs-10.

Roseland Series

The Roseland series consists of moderately deep, well-drained, gently sloping to strongly sloping soils on uplands. These soils formed in residuum from shale. The native vegetation is tall prairie grasses and woody shrubs.

In a represenative profile the surface layer is silt loam about 12 inches thick. The upper part is very dark gray, and the lower part is brown. The subsoil is yellowish-brown, very firm shaly silty clay loam about 6 inches thick. The underlying material is yellowish-brown, light yellowish-brown, and brownish-yellow shaly silty clay loam. Shale bedrock is at a depth of 56 inches.

Permeability is moderate, available water capacity is low, and content of organic matter is moderate. Natural fertility is low, and runoff is medium to rapid. The major limitation to the use of these soils is droughtiness.

Most areas of these soils are used for grasses, pasture, scattered brush, and trees of poor quality.

Representative profile of Roseland silt loam, 2 to 10 percent slopes, in a pasture, 1,020 feet north and 30 feet west of the southeast corner of sec. 24, T. 43 N., R. 28 W.:

A1—0 to 8 inches, very dark gray (10YR 3/1) silt loam, very dark grayish brown (10YR 3/2) when crushed; strong, fine, granular structure; friable; common fine roots; strongly acid; clear, smooth boundary.

A3—8 to 12 inches, brown (10YR 4/3) silt loam; weak, fine, subangular blocky structure; friable; few fine roots; strongly acid; clear, smooth boundary.

B—12 to 18 inches, yellowish-brown (10YR 5/4) shaly silty clay loam; weak, fine, subangular blocky structure; very firm; 80 percent shale fragments; very strongly acid; clear, smooth boundary.

C1—18 to 25 inches, yellowish-brown (10YR 5/4) and light yellowish-brown (10YR 6/4) shaly silty clay loam; massive; hard; many partly decomposed shale fragments that have yellowish-brown (10YR 5/8) interiors; very strongly acid; clear, smooth boundary.

C2—25 to 56 inches, brownish-yellow (10YR 6/6), yellowish-brown (10YR 5/4), and light brownish-gray (2.5Y 6/2) shaly silty clay loam; massive; firm; many shale fragments; strongly acid.

C3—56 inches, shale bedrock.

The solum ranges from about 12 to 20 inches in thickness. The A1 horizon is silt loam or loam. It ranges from black (10YR 2/1) to dark brown (7.5YR 3/2). The A2 horizon, where present, is silt loam, loam, or light silty clay loam. The B horizon is shaly silty clay loam or shaly clay loam. It is brown (10YR 4/3) to light brown (7.5YR 6/4) and has higher chroma mottles in the upper part and lower chroma mottles in the lower part. The B horizon is strongly acid or very strongly acid.

Roseland soils are near Barco, Deepwater, and Hartwell soils. Roseland soils are steeper and have a thinner, less prominent B horizon than all of these soils.

Roseland silt loam, 2 to 10 percent slopes (RoC).—This soil is on side slopes below Barco, Deepwater, and Hartwell soils. Areas generally are small and have complex slopes.

This soil has the profile described as representative for the series. The underlying material includes sandstone and shale as well as the shaly silty clay loam described.

Included with this soil in mapping are soils that formed under timber vegetation and that have a grayish-brown surface layer. Also included, and making up as much as 15 percent of the total acreage, are some soils that are 18 to 30 inches thick over the shale substratum. These included soils are similar to Deepwater soils in appearance but lack the thick subsoil of Deepwater soils.

The Roseland soil has a friable surface layer and generally has short slopes that break sharply into steeper slopes. This, plus the presence of shale at a depth of about 18 inches, makes this soil generally unsuited to regular tillage. Available water capacity and natural fertility are low. Runoff is medium to rapid. The major limitation to use of this soil is susceptibility to erosion. Droughtiness throughout much of the growing season is also a significant limitation.

This soil is mainly suited to hay, meadow, and pasture crops, and to less intensive uses. Capability unit IVe–11.

Roseland silt loam, 10 to 15 percent slopes (RoD).—This soil is on side slopes below Deepwater soils and less sloping Roseland soils. Areas are generally small and elongated and are parallel to the slope.

This soil has a profile similar to that described as representative for the series, but it is more rolling and the tracts generally show less evidence of past tillage.

Included with this soil in mapping are areas of soils that have a thicker subsoil. These included areas make up as much as 10 percent of the total acreage. They are similar to Deepwater soils in appearance, but the subsoil is not so thick as that of Deepwater soils. Also included are areas of soils that formed under timber vegetation and have a grayish-brown surface layer.

The surface layer is friable, and slopes are short and break sharply into more sloping eroded areas. This, plus the presence of shale at a depth of about 18 inches, makes this soil generally unsuited to regular tillage. Available water capacity and natural fertility are low. Runoff is rapid. The major limitations to the use of this soil are susceptibility to erosion and droughtiness.

This soil is mainly suited to hay and pasture and to less intensive uses. Control of erosion is a necessary part of good management. Capability unit VIe–11.

Roseland shaly silt loam, 5 to 15 percent slopes, severly eroded (RsD3).—This soil is on side slopes near Deepwater soils and less eroded Roseland soils. The areas are irregular in shape, are generally less than 2 acres in size, and have numerous small gullies or areas devoid of the original surface layer.

This soil has a profile similar to that described as representative for the series, but slopes are somewhat steeper and shorter. The original surface layer is absent or quite thin, and the subsurface layer is absent or obscure. Shale fragments on the surface and in the subsoil are common, and the shale substratum is closer to the surface, ranging from 0 to 12 inches in depth.

This soil is not well suited to regular tillage. Because of erosion, the present surface layer is slightly plastic when wet and firm when dry. Available water capacity is low, runoff is rapid, and natural fertility is low. The major limitation to use of this soil is drough-

tiness. Damage to the soil from erosion and susceptibility to erosion are also significant limitations.

This soil is mainly suited to grass for pasture or to the establishment of wildlife cover. Establishment of cover is difficult and requires careful selection of plant species. Capability unit VIIe–11.

Snead Series

The Snead series consists of moderately deep, moderately well drained, gently sloping to strongly sloping soils on uplands. These soils formed in residuum from clayey shales and thin, interbedded limestone. The native vegetation is tall prairie grass.

In a representative profile the surface layer is very dark gray silty clay about 9 inches thick. The subsoil is very firm silty clay about 15 inches thick. The upper part of the subsoil is dark grayish brown, and the lower part is olive brown. The underlying material is mottled, grayish-brown, light olive-brown, light brownish-gray, and olive-yellow silty clay.

Permeability is slow, available water capacity is low, and content of organic matter is high. Natural fertility is medium, and runoff is medium to rapid. The major limitation to the use of these soils is susceptibility to erosion.

Most of the gently sloping areas of these soils are used for cultivated crops. The moderately sloping and strongly sloping areas are used mostly for grasses, legumes, hay, and pasture.

Representative profile of Snead silty clay, 5 to 15 percent slopes, eroded, in a lespedeza-sweet clover meadow, 1,120 feet east and 500 feet south of the northwest corner SE¼ sec. 4, T. 43 N., R. 27 W.:

A1—0 to 9 inches, very dark gray (10YR 3/1) silty clay; moderate, medium, granular structure; firm; few manganese and iron concretions; mildly alkaline; clear, smooth boundary.

B21—9 to 15 inches, dark grayish-brown (2.5Y 4/2) silty clay; strong, medium, subangular blocky structure; very firm; few manganese and iron concretions; mildly alkaline; gradual, smooth boundary.

B22—15 to 24 inches, olive-brown (2.5Y 4/4) silty clay; strong, medium, subangular blocky structure; very firm; black iron stains; mildly alkaline; gradual, smooth boundary.

C1—24 to 32 inches, mottled grayish-brown (2.5Y 5/2) and light olive-brown (2.5Y 5/6) silty clay; soapy when moist; soft, weathered shale; firm; few calcium carbonate concretions; moderately alkaline; diffuse, smooth boundary.

C2—32 to 60 inches, mottled light brownish-gray (2.5Y 6/2) and olive-yellow (2.5Y 6/6) silty clay; soapy when moist; soft, weathered shale; firm; common calcium carbonate concretions; moderately alkaline.

The A horizon ranges from silty clay loam to silty clay in texture. The A and B horizons combined range from 20 to 36 inches in thickness. Small disk-shaped phosphatic concretions commonly are scattered on the surface, and a few flat limestone rocks are on the surface and throughout the soil.

Snead soils in this county lack free carbonates to a depth of more than 20 inches and are therefore not within the range defined for the series, but this difference does not alter their usefulness or behavior.

Snead soils are near Summit soils. They lack the distinct horizons of the Summit soils, generally have a thinner solum, and are alkaline rather than acid.

Snead silty clay, 2 to 5 percent slopes (SnB).—This soil generally is on narrow ridge crests and the upper part of side slopes. In places it is at the base of the more steeply rolling mounds and knolls. It is near Summit soils that generally are more rolling and near more sloping Snead soils on the side slopes. Areas are normally elongated and 3 to 8 acres in size. Limestone outcroppings are common.

Available water capacity is slow, permeablity is slow, and natural fertility is medium. Runoff is medium. Most areas of this soil are tilled and cropped regularly. The major limitation to the use of this soil is susceptibility to erosion. This soil tends to remain wet and seepy in the wetter seasons.

This soil is mainly suited to grasses and legumes. It is not so well suited to soybeans and small grain. This soil also is suited to less intensive uses. The low available water capacity somewhat restricts the choice of plants. Control of erosion is a necessary part of good management. Capability unit IVe–11.

Snead silty clay, 2 to 5 percent slopes, eroded (SnB2).—This soil is on complex side slopes near Summit soils. Areas are 3 to 20 acres in size and commonly are at the head of drainageways.

This soil has a profile similar to that described as representative for the series, but erosion has removed 4 inches or more of the original surface layer and the resultant surface layer is very dark grayish-brown silty clay about 5 inches thick. The subsoil ranges from 5 to 10 inches in thickness and is slightly thinner than that of the uneroded Snead soils. There are a few gullies. Limestone bedrock is at a depth of 20 to 36 inches in some areas.

Available water capacity is low, natural fertility is medium, and permeability is slow. Runoff is medium. The surface layer tends to crack during periods of drought. The major limitation to the use of this soil is susceptibility to erosion, but seasonal wetness and occasional seepy spots are also limitations.

This soil is well suited to tillage, and most areas are cropped. However, the irregular nature of the slopes, the presence of gullies, and the presence of seeps commonly necessitate use of complex management practices. Control of erosion is a necessary part of good management. This soil is suited to grasses, legumes, and small grain, and to less intensive uses. Capability unit IVe–11.

Snead silty clay, 5 to 15 percent slopes, eroded (SnC2).—This soil is on the upper part of sharply breaking, complex side slopes and at the head of drainageways. Areas at the head of drainageways are marked by many water channels and a few gullies. This soil generally is near less sloping Snead and Summit soils. The areas generally are 2 to 15 acres in size.

This soil has the profile described as representative for the series. In some eroded areas the surface layer is very dark grayish-brown silty clay 2 to 6 inches thick. The upper part of the subsoil is commonly disturbed by tillage, and it is absent in some of the more severely eroded areas. Some areas of this soil have thin bands of rock outcrop scattered intermittently. There are some areas where erosion has been less severe.

Available water capacity is low, natural fertility is medium, and permeability is slow. Runoff is rapid. Areas of this soil are normally difficult to till, because of irregular slopes and differences in grade within short distances.

This soil is well suited to hay and meadow crops and to less intensive uses. Control of erosion is a necessary part of good management. Capability unit VIe–11.

Summit Series

The Summit series consists of deep, somewhat poorly drained, gently sloping to moderately sloping soils on uplands and foot slopes. These soils formed in residuum or colluvial material weathered from shale and interbedded limestone. The native vegetation is tall prairie grasses.

In a representative profile the surface layer is black and is about 13 inches thick. The upper part is silty clay loam, and the lower part is silty clay. The subsoil is very firm and is about 29 inches thick. The upper part of the subsoil is very dark gray silty clay, the middle part is dark-gray clay, and the lower part is light brownish-gray and olive-yellow silty clay. The underlying material is mottled, calcareous silty clay.

Permeability is slow, available water capacity is moderate, and content of organic matter is high. Natural fertility is high, and runoff is medium to rapid. The major limitation to the use of these soils is susceptibility to erosion.

About half of the acreage of these soils is used for corn, soybeans, and sorghum. Most of the remaining area is in grasses and legumes that are used for pasture or hay.

Representative profile of Summit silty clay loam, 2 to 5 percent slopes, in an alfalfa field, 200 feet east and 1.120 feet north of the middle of sec. 26, T. 43 N., R. 27 W.:

Ap—0 to 7 inches, black (10YR 2/1) silty clay loam; moderate, medium, granular structure; firm; neutral; abrupt, smooth boundary.

A3—7 to 13 inches, black (10YR 2/1) silty clay; moderate, fine subangular blocky structure; very firm; few iron and manganese concretions; slightly acid; gradual, smooth boundary.

B1—13 to 19 inches, very dark gray (10YR 3/1) silty clay; few, fine, distinct, light olive-brown (2.5YR 5/4) mottles; strong, fine, subangular blocky structure: very firm; discontinuous clay films; few iron and manganese concretions; medium acid; gradual, smooth boundary.

B21t—19 to 27 inches, dark-gray (10YR 4/1) clay; medium, distinct, dark-brown (10YR 4/3) and yellow (10YR 7/6) mottles; strong, medium, angular and subangular blocky structure; very firm; clay films on most ped surfaces; common iron and manganese concretions; strongly acid; diffuse, smooth boundary.

B22t—27 to 34 inches, dark-gray (10YR 4/1) clay; common, medium, distinct, light olive-brown (2.5Y 5/4) and dark yellowish-brown (10YR 4/4) mottles; strong, medium, subangular blocky structure; very firm; gray (10YR 5/1) clay films on all ped surfaces; common iron and manganese concretions; slightly acid; diffuse, smooth boundary.

B3—34 to 42 inches, mottled light brownish-gray (2.5Y 6/2) and olive-yellow (2.5Y 6/6) heavy silty clay; moderate, medium, blocky structure; very firm; grayish-brown (2.5Y 5/2) clay films on many ped surfaces; some calcium carbonate and phosphatic concretions; mildly alkaline; diffuse, smooth boundary.

C—42 to 60 inches, mottled light brownish-gray (2.5Y 6/2) and olive-yellow (2.5Y 6/6) heavy silty clay; massive; very firm; many calcium carbonate and phosphatic concretions; many shale fragments; moderately alkaline.

The Ap horizon ranges from silt loam to silty clay loam. The A horizon ranges from 7 to 14 inches in thickness. The Ap horizon ranges from black (10YR 2/1) to very dark grayish brown (10YR 3/2). Yellow mottles in the B21 horizon are in many places less pronounced. Carbonates commonly are absent in the upper 5 feet of the profile but in places are as near as 30 inches to the surface.

Summit soils are near Snead, Newtonia, and Deepwater soils. They have a thicker A horizon, greater development of clay films, and a normally thicker solum than Snead soils. The B horizon of Summit soils is higher in clay content than that of Deepwater soils. Summit soils have a finer textured B horizon than Newtonia soils.

Summit silty clay loam, 2 to 5 percent slopes (SuB).—This soil is on narrow ridgetops, on concave side slopes, and on foot slopes. In places the foot slopes receive seepage and runoff from soils at higher elevations. Areas range from 5 to 40 acres in size.

This soil has the profile described as representative for the series. It is intermingled with Snead and Deepwater soils, which make up as much as 10 percent of the total acreage, and with eroded Summit soils, which make up as much as 15 percent.

Available water capacity is moderate, permeability is slow, and natural fertility is high. Runoff is medium. The major limitation to the use of this soil is susceptibility to erosion. Seasonal wetness, caused by slow internal drainage and seepiness in some places, is also a limitation. The somewhat restricted available water capacity is also a limitation in seasons of low rainfall.

This soil is well suited to tillage. Most areas are cropped. The soil is suited to corn, sorghum, small grain, grasses, and legumes, and to less intensive uses. Control of erosion is a necessary part of good management. Capability unit IIe–5.

Summit silty clay loam, 2 to 5 percent slopes, eroded (SuB2).—This soil is on side slopes and on foot slopes. In places it receives runoff from higher elevations. Areas are commonly elongated and range from 5 to 40 acres in size.

This soil has a profile similar to that described as representative for the series, but the surface layer ranges from 3 to 7 inches in thickness. The original surface layer commonly has been mixed into the present plow layer. Texture of the surface layer ranges to heavy silty clay loam and is silty clay in the more severely eroded spots. The surface layer is very dark gray.

Included with this soil in mapping are areas of uneroded Summit silty clay loam, 2 to 5 percent slopes, that are generally located midway between the drainageways. Also included are areas of Snead and Deepwater soils that generally make up less than 20 percent of the mapped areas.

This soil is well suited to tillage although the surface layer is quite firm when moist and plastic when wet. Available water capacity is moderate, permeability is slow, and runoff is rapid. Natural fertility is me-

dium to high. The major limitations to the use of this soil are damage from past erosion, high runoff, and susceptibility to erosion. This soil also has a tendency to crack, and plants are injured by moisture shortages in dry seasons.

This soil is suited to corn, sorghum, small grain, grasses, and legumes, and to less intensive uses. Capability unit IIIe–5.

Summit silty clay loam, 5 to 10 percent slopes (SuC).—This soil is on side slopes and at the head of drainageways. Areas range from 3 to 25 acres in size and are elongated or fan shaped. This soil generally is in fields of dominantly less sloping Summit soils.

This soil has a profile similar to that described as representative for the series, but it has more drainage channels and the surface layer is thinner. The surface layer rarely exceeds 9 to 10 inches in thickness.

Included with this soil in mapping are small spots of eroded soils and narrow bands of Snead and Deepwater soils. These included soils make up as much as 20 percent of mapped areas.

Available water capacity is moderate, permeability is slow, and natural fertility is high. Runoff is rapid. The major limitation to the use of this soil is susceptibility to erosion. Seasonal wetness, caused by slow internal water movement and a few seepy spots, is also a limitation.

This soil is suited to corn, soybeans, sorghum, grasses, and legumes, and to less intensive uses. Capability unit IVe–8.

Summit silty clay loam, 5 to 10 percent slopes, eroded (SuC2).—This soil is on complex side slopes and at the head of drainageways. Areas range from 3 to 40 acres in size.

This soil has a profile similar to that described as representative for the series, but the surface layer is somewhat thinner. The original surface layer commonly has been obliterated by erosion and tillage. Texture of the plow layer ranges to heavy silty clay loam because the upper and lower parts of the original surface layer have been mixed. The plow layer is very dark gray because material from the grayer underlying layer has been mixed into it.

Included with this soil in mapping are spots of severely eroded soils that have a surface layer of silty clay and a few spots of uneroded soils. Also included are small areas of Deepwater soils at the upper margin of some mapped areas and small areas of Snead soils, commonly at the lower margin of slopes.

Available water capacity is moderate, and permeability is slow. Natural fertility is high, and runoff is rapid.

This soil is mainly suited to small grain, grasses, and legumes, but row crops can be grown on a limited basis if erosion control practices are carefully applied. Capability unit IVe–8.

Urich Series

The Urich series consists of deep, poorly drained, nearly level soils on stream terraces and in positions subject to flooding. These soils formed in alluvium. The native vegetation is tall prairie grasses.

In a representative profile the surface layer is very dark grayish-brown silt loam about 13 inches thick. The subsoil is dark-gray and gray, firm silty clay loam that extends to a depth of more than 60 inches.

Permeability is slow, available water capacity is high to very high, and content of organic matter is high. Natural fertility is medium, and runoff is slow. The major limitations to the use of these soils are wetness and susceptibility to flooding.

Most large areas of these soils are used for corn and soybeans. The small, narrow, channeled areas are in grass, pasture, or scattered trees.

Representative profile of Urich silt loam in a soybean field, 200 feet west and 30 feet south of the northeast corner of SE¼ sec. 3, T. 40 N., R. 26 W.:

Ap—0 to 8 inches, very dark grayish-brown (10YR 3/2) silt loam; weak, fine, granular structure; friable; some iron stains in cracks; slightly acid; abrupt, smooth boundary.

A3—8 to 13 inches, very dark grayish-brown (10YR 3/2) silt loam, very dark grayish brown (10YR 3/2) when crushed; weak, fine, blocky structure; friable; few dark-gray (10YR 4/1) streaks; strongly acid; gradual, smooth boundary.

B21tg—13 to 21 inches, dark-gray (10YR 4/1) silty clay loam; fine, distinct, dark yellowish-brown (10YR 4/4) mottles; moderate, medium, angular blocky structure; firm; strongly acid; gradual, smooth boundary.

B22tg—21 to 30 inches, dark-gray (10YR 4/1) silty clay loam; few, fine, distinct, dark yellowish-brown (10YR 4/4) mottles; moderate, coarse, angular blocky structure; firm; many dark-colored concretions; strongly acid; gradual, smooth boundary.

B23tg—30 to 38 inches, dark-gray (10YR 4/1) silty clay loam; common, fine, distinct, yellowish-brown (10YR 5/4) and gray (10YR 6/1) mottles; moderate, medium, angular blocky structure; very firm; discontinuous clay films on ped surfaces; medium acid; gradual, smooth boundary.

B3tg—38 to 64 inches, gray (10YR 5/1) silty clay loam; common, fine, distinct, dark yellowish-brown (10YR 4/4) mottles; moderate, fine, angular blocky structure; firm; few dark-gray (10YR 4/1) clay films; slightly acid.

The solum ranges from 36 to 60 inches or more in thickness. The A1 or Ap horizon ranges from black (10YR 2/1) to very dark grayish brown (10YR 3/2) in color and from 5 to 12 inches in thickness. The B horizon ranges from dark gray (10YR 4/1) to grayish brown (2.5Y 5/2) in color and from strongly acid to slightly acid in reaction. The B2 horizon ranges from silty clay loam to light silty clay.

Urich soils are near Quarles and Muldrow soils. They differ from Quarles soils in having a thicker dark-colored surface layer, an A3 horizon, and less clay in the B horizon. They are more acid, are lower in content of phosphate, and have a thinner surface layer than Muldrow soils.

Urich silt loam (Ur).—This soil occupies overflow positions in stream valleys. Slopes are less than 1 percent. Areas are narrow and elongated along the tributary streams and range from 10 to 40 acres or more in size in the major stream valleys.

Included with this soil in mapping are areas of soils that have a surface layer of light silty clay loam. These included soils make up as much as 20 percent of the total acregae. Also included are areas of Quarles soils on small natural levees and Osage soils in depressions.

This soil generally is well suited to tillage except where it is located in narrow stream valleys that are

cut by meandering stream channels. Available water capacity is high to very high, permeability is slow, and natural fertility is medium. The major limitation to the use of this soil is slight wetness caused by ponding and occasional flooding. Flooding normally is of short duration.

This soil is suited to corn, soybeans, sorghum, grasses, and legumes and to less intensive uses such as hay, pasture, and wildlife food and cover. Capability unit IIw–1.

Verdigris Series

The Verdigris series consists of deep, moderately well drained, nearly level soils on first bottoms adjacent to streams. These soils formed in silty alluvium. The native vegetation is lowland deciduous forest.

In a representative profile the soil material is very dark grayish-brown, friable silt loam that extends to depth of more than 60 inches.

Permeability is moderate, available water capacity is very high, and content of organic matter is high. Natural fertility is high, and runoff is slow. The major limitation to use of these soils is susceptibility to flooding.

Most areas of these soils are used for corn, soybeans, sorghum, and alfalfa. Some areas in narrow channels and along meandering streams are in grass, pasture, or trees.

Representative profile of Verdigris silt loam, in a cornfield, 260 feet west and 50 feet south of the northeast corner of NW¼NW¼ sec. 33, T. 44 N., R. 27 W.:

Ap—0 to 7 inches, very dark grayish-brown (10YR 3/2) silt loam; weak, fine, granular structure; friable; slightly acid; abrupt, smooth boundary.

C—7 to 60 inches, very dark grayish-brown (10YR 3/2) silt loam; thin, light brownish-gray (10YR 6/2) bedding planes in places; friable; slightly acid.

The profile ranges from neutral to strongly acid and is more than 60 inches deep. The thickness of the dark-colored layers ranges from 24 inches to more than 60 inches. The Ap horizon or the A1 horizon is very dark grayish brown (10YR 3/2), dark brown (10YR 3/3), or very dark brown (10YR 2/2). Texture is dominantly silt loam but ranges from silty clay loam to loam. The Ap horizon is 6 to 9 inches thick. The underlying material is dominantly very dark grayish brown (10YR 3/2), dark brown (10YR 3/3), and dark yellowish brown (10YR 4/4), but darker or lignter strata are present at varying depths in places.

Verdigris soils are near Urich and Osage soils. They have browner colors and less clay throughout the solum than these soils.

Verdigris silt loam (Ve).—This soil generally is on natural levees along stream channels or on taluses adjacent to upland drainageways. Slopes are less than 1 percent. Areas have a wide variation in size and shape. They range from small triangular or narrow elongated areas 3 to 5 acres in size to rather broad areas 40 to 80 acres in size.

Included with this soil in mapping are some areas where brown silty overwash material covers Urich soils. About 15 percent of all the areas have a lighter colored surface layer than the Verdigris soils. Also included are small areas of Urich and Muldrow soils that make up less than 10 percent of the total acreage. The surface layer of these soils is dominantly silt loam but is loam and fine sandy loam in places. These sandier soils make up 5 to 15 percent of some mapped areas.

Available water capacity is very high, and permeability is moderate. The major limitation to the use of this soil is susceptibility to flooding. Nearly all areas are subject to occasional flooding. The period of inundation is brief early in spring, but it lasts as long as 2 to 3 weeks when major streams are at flood stage. In areas where natural levees or recut stream channels provide adequate outlets, damaging floods do not occur.

This soil is well suited to cultivation, but some areas are cut by meandering stream channels and are characterized by small, odd-shaped fields. It is suited to all locally grown crops, including a wide range of legumes and trees. Capability unit IIw–1.

Use and Management of the Soils

This section gives information on the use and management of the soils in Henry County for crops and pasture, explains the sytem of capability classification used by the Soil Conservation Service, and describes the management of the soils by capability unit. In addition, predicted yields for principal crops are listed, and use and management of the soils for woodland, wildlife, recreation, and engineering purposes are discussed.

Specific management for individual soils is not suggested in this section. Detailed information on use and management can be provided by local offices of the Soil Conservation Service or the Henry County Cooperative Extension Service.

Crops and Pasture

About 75 percent of the acreage of Henry County is used for crops and pasture. The main crops are corn, soybeans, wheat, and grain sorghum. Tall fescue makes up about 70 percent of the total forage grown. Other forage plants are bluegrass, redtop, bromegrass, lespedeza, and ladino clover.

The major limitations to the use of the soils for crops and pasture are susceptibility to erosion, wetness, droughtiness, and flooding. Management practices that control runoff, that maintain or increase the content of organic matter and the level of fertility, and that preserve good tilth are needed on most of the soils. About 75 percent of the acreage in the county consists of sloping soils on uplands and is susceptible to erosion. Many of the areas of these soils have been damaged to a moderate degree by erosion. Many of the soils on bottom lands are marshy or are in narrow bands along meandering streams. Watershed protection that includes planning and management for the control of erosion, flooding, and drainage is needed to achieve the maximum production potential of the soils on bottom lands and in adjacent drainageways. Supplemental irrigation of soils, both on uplands and on bottom lands, consistent with the available water

supply helps to increase crop growth. Pasture improvement and renovation, coupled with good grazing management, are needed in many grazing areas.

Capability grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The groups are made according to the limitations of the soils when used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to horticultural crops or other crops requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for forest trees or engineering.

In the capability system, all kinds of soils are grouped at three levels: the capability class, the subclass, and the unit. These are discussed in the following paragraphs.

CAPABILITY CLASSES, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, defined as follows:

- Class I soils (none in Henry County) have few limitations that restrict their use.
- Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.
- Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.
- Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.
- Class V soils (none in Henry County) are not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture or range, woodland, or wildlife habitat.
- Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife habitat.
- Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture or range, woodland, or wildlife habitat.
- Class VIII soils and landforms (none in Henry County) have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife habitat, or water supply, or to esthetic purposes.

CAPABILITY SUBCLASSES are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, woodland, wildlife habitat, or recreation.

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe–4 or IIIe–6. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass or kind of limitation as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

Capability unit numbers generally are assigned locally but are a part of a statewide system. All of the units in the system are not represented by the soils of Henry County; therefore, the capability unit numbers in this soil survey are not consecutive.

In the following pages the capability units represented in Henry County are described, and suggestions for the use and management of the soils are given.

CAPABILITY UNIT IIe–1

This unit consists of deep, gently sloping soils on high terraces and uplands. These soils are well drained and moderately well drained, and they have a medium-textured surface layer.

Natural fertility is medium to high. Available water capacity is high to very high, and permeability is moderate. Runoff is slow to medium. The content of organic matter is moderate to high.

The soils in this unit are suited to corn, sorghum, soybeans, small grain, grasses, and legumes. They are also suited to trees, to food and cover for wildlife, and to less intensive uses.

The major limitations to the use of these soils are susceptibility to erosion and runoff. The major management practices needed are those that maintain the content of organic matter and fertility, that improve and maintain tilth, and that control erosion. Use of crop residue, cover crops, and green-manure crops helps to maintain the content of organic matter and tilth. These practices, used along with terraces, mini-

mum tillage, and contour tillage, help to reduce runoff and to control erosion. Crops respond well to irrigation and to applications of lime and fertilizer.

CAPABILITY UNIT IIe-4

This unit consists of moderately deep, gently sloping soils on uplands. These soils are well drained and have a medium-textured surface layer.

Natural fertility is low to medium. Available water capacity and permeability are moderate. Runoff is medium. The content of organic matter is low or high.

The major limitations to the use of these soils are runoff and the hazard of erosion.

The soils in this unit are suited to sorghum, small grain, grasses, and legumes, including alfalfa. The major management practices needed are those that maintain organic matter and fertility, improve and maintain tilth, and control erosion. Minimum tillage, contour farming, stripcropping, winter cover crops, terraces, and grassed waterways help to control erosion and runoff. Use of crop residue and green-manure crops helps to maintain and improve organic-matter content, fertility, and tilth.

CAPABILITY UNIT IIe-5

This unit consists of deep, gently sloping soils on uplands. These soils are moderately well drained and somewhat poorly drained and have a medium-textured or moderately fine textured surface layer.

Natural fertility is medium to high. Available water capacity is moderate. Runoff is medium. The content of organic matter is high.

The major limitations to the use of these soils are runoff and the hazard of erosion.

The soils in this unit are suited to corn, soybeans, sorghums, small grain, grasses (fig. 8), and legumes. The major management practices required are those that maintain organic matter and fertility, improve and maintain tilth, and control erosion. The use of crop residue, cover crops, and green-manure crops helps to maintain organic matter and tilth. These practices, along with terraces, minimum tillage, and contour tillage, help to retard runoff and reduce erosion.

***Figure 8.*—Area of pasture on Summit silty clay loam, 2 to 5 percent slopes.**

CAPABILITY UNIT IIe-6

Only Hartwell silt loam, 2 to 4 percent slopes, is in this unit. This soil is somewhat poorly drained and has a medium-textured surface layer over a claypan. It is gently sloping and is on uplands.

Natural fertility is medium. Available water capacity is moderate, and permeability is slow. Runoff is medium. The content of organic matter is high.

The major limitations to the use of this soil are runoff and the hazard of erosion.

This soil is suited to corn, soybeans, sorghums, small grain, grasses, and legumes (fig. 9). It is also suited to wildlife food and cover plants and to other less intensive uses. The major management practices required are those that maintain organic matter and fertility, improve and maintain tilth, and control erosion. The use of organic residue, cover crops, and green-manure crops helps to maintain organic matter, tilth, and available water capacity. These practices, along with terraces, minimum tillage, and contour tillage, help to retard runoff and reduce erosion.

CAPABILITY UNIT IIw-1

This unit consists of deep, nearly level and level soils on bottom lands. These soils are moderately well drained to poorly drained.

Natural fertility is medium to high. Available water capacity is moderate to very high, and permeability is moderate to very slow. Runoff is slow to very slow. The content of organic matter is moderate to high.

The major limitations to the use of these soils are seasonal wetness because of excess water from runoff, ponding, and flooding.

The soils in this unit are suited to corn, sorghum, soybeans, small grain, grasses, and legumes (fig. 10). Generally, alfalfa is not well suited. Most areas of these soils are cropped. Areas cut up by meandering stream channels are in scattered trees and grasses.

Return of crop residue and the use of green-manure crops and cover crops help to maintain organic matter, tilth, and available water capacity. Crops respond well to additions of fertilizer and lime.

CAPABILITY UNIT IIw-2

Only Hartwell silt loam, 0 to 2 percent slopes, is in this unit. This soil is somewhat poorly drained and has a medium-textured surface layer over a claypan. It is nearly level and is on uplands.

Natural fertility is medium. Available water capacity is moderate, and runoff is slow. The content of organic matter is high.

The major limitation to the management of this soil is wetness.

This soil is easy to till. It is normally wet in spring and fall during periods of rainfall. Response to man-

Figure 9.—**Corn and pasture on an area of Hartwell silt loam, 2 to 4 percent slopes.**

agement is fair. This soil is suited to sorghum, soybeans, corn, small grain, grasses, and legumes (fig. 11). It is also suited to wildlife food and cover plants. The use of crop residue, cover crops, and green-manure crops helps to maintain organic matter, tilth, and available water capacity. Irrigation is beneficial.

CAPABILITY UNIT IIIe-1

This unit consists of deep, well drained and moderately well drained, moderately sloping soils on uplands.

Natural fertility is medium to high. Available water capacity is high to very high, and permeability is moderate.

The soils in this unit are well suited to corn, sorghum, soybeans, small grain, grasses, and legumes. They are also suited to trees, wildlife food and cover plants, and less intensive uses.

The major management practices required are those that maintain organic matter and fertility, improve and maintain tilth, and control erosion. Use of crop residue, cover crops, and green-manure crops helps to maintain organic matter, tilth, and available water capacity. These practices, along with terraces, minimum tillage, and contour tillage, help to retard runoff and reduce erosion.

CAPABILITY UNIT IIIe-4

This unit consists of deep and moderately deep, gently sloping to moderately sloping soils on uplands. These soils are well drained and moderately well drained.

Natural fertility is medium to high. Available water capacity is moderate to high, and permeability is moderate. Runoff is medium to rapid. The content of organic matter is moderate to high.

These soils are moderately well suited to corn, soybeans, and small grain. The major management practices required are those that maintain organic matter and fertility, improve and maintain tilth, and control erosion. Minimum tillage, contour farming, stripfarming, winter cover crops, terraces, and grassed waterways help to control erosion and runoff. Use of crop residue and green-manure crops helps to improve and maintain organic-matter content, fertility, and tilth.

CAPABILITY UNIT IIIe-5

This unit consists of deep, gently sloping to moderately sloping soils on uplands. These soils have a medium-textured or moderately fine textured surface layer and a moderately fine textured or fine textured subsoil.

Figure 10.—**Pecan trees are common in areas of pasture on Osage silty clay loam.**

They are moderately well drained or somewhat poorly drained.

Natural fertility is medium to high. Available water capacity is moderate. Runoff is medium to rapid. The content of organic matter is high.

These soils are moderately well suited to corn, soybeans, and small grain. The major management practices required are those that maintain organic matter and fertility, improve and maintain tilth, and control erosion. Minimum tillage, contour farming, stripcropping, winter cover crops, terraces, and grassed waterways help to control erosion and runoff. Use of crop residue and green-manure crops helps to improve and maintain organic-matter content, fertility, and tilth.

CAPABILITY UNIT IIIe–6

This unit consists of deep, gently sloping soils on benches, terraces, and uplands. These soils are somewhat poorly drained and have a medium-textured surface layer over a claypan.

Natural fertility is low or medium. Available water capacity is moderate. Runoff is medium. The content of organic matter is low to high.

These soils are moderately well suited to corn, soybeans, and small grain. The major management practices required are those that maintain organic matter content and fertility, improve and maintain good tilth, and control erosion. Minimum tillage, contour farming, winter cover crops, terraces, and grassed waterways help to control erosion and runoff. Use of crop residue and green-manure crops helps to improve and maintain organic-matter content, fertility, and tilth.

CAPABILITY UNIT IIIe–7

This unit consists of moederately deep, gently sloping soils on uplands. These soils are well drained.

Natural fertility is low to medium. Available water capacity is moderate. Runoff is medium. The content of organic matter is low or medium.

The major limitations to the use of these soils are runoff and the hazard of erosion. Seasonal droughtiness is also a limitation.

The soils in this unit are suited to small grain, sorghum, grasses, and legumes and in places are suited to corn and soybeans. They are well suited to hay and pasture. The major management practices required are those that maintain organic-matter content and fertility, improve and maintain tilth, and control erosion. Erosion control practices such as terracing, minimum tillage, limited row crops, and contour cultivation are essential for sustained cropping. Crops respond well to additions of lime and fertilizer.

CAPABILITY UNIT IIIw–2

This unit consists of deep, nearly level and gently sloping soils on flood plains, benches, and uplands. These soils are somewhat poorly drained and poorly

Figure 11.—**Harvested hay on Hartwell silt loam, 0 to 2 percent slopes.**

drained, and they have a medium-textured surface layer and a moderately fine textured subsoil.

Natural fertility is low. Available water capacity is moderate to high. Runoff is very slow to medium. The content of organic matter is low to moderate.

The major limitations to the use of these soils are seasonal wetness and droughtiness.

The soils in this unit are easy to till. They are normally wet in spring and fall during periods of rainfall. Response to management is fair. These soils are suited to sorghum, soybeans, small grain, grasses, and legumes. Alfalfa is not well suited. The use of crop residue, cover crops, and green-manure crops helps to maintain organic-matter content, tilth, and available water capacity. Irrigation is beneficial.

CAPABILITY UNIT IIIw-14

Only Osage silty clay is in this unit. This soil is deep and nearly level and is on bottom lands. It has a fine-textured surface layer and subsoil and is poorly drained.

Natural fertility is high. Available water capacity is moderate, and permeability is very slow. Runoff is slow to very slow. The content of organic matter is high.

The major limitation to the use of this soil is wetness. This soil is difficult to till, because it is seasonally wet and has a hard surface layer in dry seasons. Much of the acreage of this unit has inadequate outlets for surface drainage and is subject to flooding.

This soil is suited to soybeans, corn, and some water-tolerant grasses where drainage is adequate. The natural cover is marsh grass. Alfalfa is not well suited. The use of crop residue, cover crops, and fall plowing helps to improve tilth. These practices, along with surface drainage and adequate outlets, make this soil suitable for intensive row cropping.

CAPABILITY UNIT IIIs-6

This unit consists of deep, gently sloping to moderately sloping soils on uplands. These soils are well drained and are cherty.

Natural fertility is medium. Available water capacity is low, and permeability is moderate. Runoff is medium to rapid. The content of organic matter is high.

The major limitation to the use of these soils is the chert content in the surface layer and on the surface. The hazard of erosion is also a limitation.

The soils in this unit are suited to small grain, grasses, and legumes, including alfalfa. An occasional year of sorghum or corn can be grown as a part of a long rotation that includes hay and pasture crops. The use of crop residue, cover crops, and green-manure crops helps to maintain organic-matter content, tilth, and available water capacity. These practices, along

with terraces, minimum tillage, and contour farming help to reduce runoff and control erosion.

CAPABILITY UNIT IVe-4

Only Deepwater silty clay loam, 5 to 10 percent slopes, severely eroded, is in this unit. This soil is deep and moderately well drained, has a moderately fine textured surface layer, and occupies uplands.

Natural fertility is high. Available water capacity is high, and permeability is moderate. Runnoff is rapid. The content of organic matter is moderate.

The major limitations to the use of this soil are runoff and the hazard of erosion. This soil is normally easy to till, but the surface layer is clayey as a result of erosion. The surface therefore tends to dry out somewhat slowly, and it is difficult to plow when wet and cracks when dry.

This soil is suited to small grain, sorghum, grasses, and legumes. It is also suited to corn and soybeans. It is well suited to hay and pasture. Erosion control practices such as terracing, minimum tillage, limited row crops, and contour cultivation are essential for sustained cropping. Crops respond well to applications of lime and fertilizer.

CAPABILITY UNIT IVe-7

This unit consists of moderately deep, gently sloping to moderately sloping, eroded soils on uplands. These soils are well drained and have a moderately coarse textured or medium-textured surface layer.

Natural fertility is low to medium. Available water capacity is moderate. Runoff is medium to rapid. The content of organic matter is low to medium.

The major limitation to the use of these soils is susceptibility to erosion.

The soils in this unit are suited to small grain, sorghum grasses, and legumes. They are also suited to corn and soybeans. They are well suited to hay and grazing. Erosion control practice such as terracing, minimum tillage, limited row crops, and contour cultivation are essential for sustained cropping. Crops respond well to applications of lime and fertilizer.

CAPABILITY UNIT IVe-8

This unit consists of deep, gently sloping to moderately sloping soils on uplands. These soils are somewhat poorly drained and have a moderately fine textured surface layer.

Natural fertility is medium to high. Available water capacity is low to moderate, and permeability is slow. Runoff is medium to rapid. The content of organic matter is moderate to high.

The major limitations to the use of these soils are runoff and the hazard of erosion. Droughtiness and difficulty of tillage operations caused by the clayey surface layer are also important limitations.

Use of erosion control practices, minimum tillage, and crop residue helps to restore tilth and reduce runoff and erosion. Crops respond well to applications of lime and fertilizer. These applications are essential to obtain good stands of cover, grain, and forage.

CAPABILITY UNIT IVe-11

This unit consists of moderately deep, gently sloping to moderately sloping soils on uplands. These soils are well drained and moderately well drained.

Natural fertility is low to medium. Available water capacity is low, and permeability is moderate to slow. Runoff is medium to rapid. The content of organic matter is moderate to high.

The major limitations to the use of these soils are runoff and the hazard of erosion. Droughtiness throughout much of the growing season is also an important limitation.

These soils are mainly suited to hay, meadow crops, and less intensive uses. Pasture renovation, along with tillage on the contour and proper woodland management, helps to maintain good-quality cover and to reduce runoff and erosion. Forage crops respond well to applications of lime and fertilizer.

CAPABILITY UNIT IVs-9

Only Goss cherty silt loam, 2 to 15 percent slopes,is in this unit. This soil is deep, well drained, and gently sloping to strongly sloping and occurs on uplands.

Natural fertility is medium. Available water capacity is low, and permeability is moderate. Runoff is medium to rapid. The content of organic matter is mooderate.

The major limitation to the use of this soil is the cherty surface layer, which causes droughtiness and makes the soil difficult to till. The hazard of erosion is also a limitation.

This soil is suited to small grain, grasses, and legumes, including alfalfa. Sorghum or corn are a suitable part of a long rotation that includes hay and pasture crops. Many areas remain wooded (fig. 12). The use of crop residue, cover crops, and green-manure crops helps to maintain organic matter, tilth, and available water capacity. These practices, along with minimum tillage and contour farming, help to reduce runoff and control erosion.

CAPABILITY VIe-7

This unit consists of moderately deep, moderately sloping to moderately steep, uneroded and severely eroded soils on uplands. These soils are well drained and have a moderately coarse textured to medium-textured surface layer.

Natural fertility is low to medium. Available water capacity and permeability are moderate. Runoff is rapid to very rapid. The content of organic matter is low to medium.

The major limitations to the use of these soils are runoff and the hazard of erosion. The soils are generally unsuited to cultivation, because of steepness of slope or the hazard of severe erosion.

These soils are suited to pasture or trees and to other less intensive uses. Most areas are in grass or trees. Pasture renovation, tillage on the contour, and pasture and woodland management help to maintain good-quality cover and reduce runoff and erosion. Forage crops respond well to applications of lime and fertilizer. Proper grazing and haying should provide for

Figure 12.—**Wooded area of Goss cherty silt loam, 2 to 15 percent slopes.**

leaving plants at an ample height so that a vigorous stand is maintained for protecting the soil from erosion.

CAPABILITY UNIT VIe–11

This unit consists of moderately deep, moderately sloping to strongly sloping soils on uplands. These soils are well drained or moderately well drained.

Natural fertility is low to medium. Available water capacity is low, and permeability is moderate or slow. Runoff is rapid. The content of organic matter is moderate to high.

The major limitation to the use of these soils is the hazard of erosion. The soils are generally unsuited to cultivation, because of steepness of slope or the hazard erosion.

These soils are suited to pasture or trees and to other less intensive uses. Most areas are in grass. Pasture renovation, tillage on the contour, and pasture and woodland management help to maintain good-quality cover and reduce runoff and erosion. Forage crops respond well to applications of lime and fertilizer. Proper grazing and haying should provide for leaving plants at an ample height so that a vigorous stand is maintained for protecting the soil from erosion.

CAPABILITY UNIT VIs–6

Only Eldon cherty silt loam, 10 to 20 percent slopes, is in this unit. This soil is deep and well drained and occurs on uplands.

Natural fertility is medium. Available water capacity is low, and permeability is moderate. Runoff is rapid. The content of organic matter is high.

The major limitations to the use of this soil are droughtiness and chert in the surface layer.

Most of this unit is generally unsuited to cultivation, and only the less sloping parts in nonstony areas can be mowed. Grasses and trees can be grown with good management. Most of the acreage is in grass and scattered trees. Controlled grazing is needed for high, sustained production of grass. Proper grazing and haying should provide for leaving the plants at an ample height so that a vigorous stand is maintained for protecting the soil from erosion.

CAPABILITY UNIT VIs–8

Only Coweta fine sandy loam, 2 to 10 percent slopes, is in this unit. This soil is shallow and well drained and occurs on uplands.

Natural fertility is low. Available water capacity is low, and permeability is moderate. Runoff is medium. The content of organic matter is high.

The major limitation to the use of this soil is droughtiness.

Most of this soil is generally unsuited to cultivation. Grasses can be grown with good management. Controlled grazing is needed for high, sustained production of grass.

CAPABILITY UNIT VIIe–7

This unit consists only of Mine pits and dumps. The steep, irregularly shaped dumps are a mixture of shale, sandstone, and the original mantle of soil stripped from the coalbeds. The pits are long and narrow, and most of them are filled with water.

Steep slopes, a litter of large sandstones on the surface in places, and many pits and gullies make tillage impractical. Runoff is rapid, and low areas are ponded or seepy. Except in some of the soils included with this mixture of material, permeability is slow or very slow and available water capacity is low. The response to management is poor. The scanty cover of brush, weeds, trees, and grasses offers little protection from erosion, which is very severe and will continue if protective cover is not maintained.

The use of Mine pits and dumps largely is restricted to grazing, woodland, or wildlife habitat. Most of the acreage is suited to woodland, wildlife food and cover, and recreation. The small, scattered areas of undisturbed soils are more suited for grazing.

Clearing the brush, smoothing the dumps, and planting suitable grasses, trees, and shrubs enhance the value of this unit for wildlife, recreation, grazing, and woodland and for growing Christmas trees.

CAPABILITY UNIT VIIe–11

Only Roseland shaly silt loam, 5 to 15 percent slopes, severely eroded, is in this unit. This soil is moderately deep and well drained, has a shaly surface layer, and occurs on uplands.

Natural fertility is low. Available water capacity is low, and permeability is moderate. Runoff is rapid. The content of organic matter is moderate.

The major limitations to the use of this soil are runoff and the hazard of erosion.

Most of this soil is generally unsuited to cultivation. Erosion control practices and controlled grazing are necessary for high, sustained production of pasture plants.

CAPABILITY UNIT VIIs–8

This unit consists of shallow, strongly sloping to moderately steep soils on uplands. These soils are well drained.

Natural fertility is low. Available water capacity is very low to low, and permeability is moderate. Runoff is rapid to very rapid. The content of organic matter is moderate to high.

The major limitations to the use of these soils are droughtiness and rock outcrops on the surface.

These soils are unsuited to cultivation. Controlled grazing and additions of lime and fertilizer are necessary for high, sustained production of pasture plants.

CAPABILITY UNIT VIIs–9

Only Goss cherty silt loam, 15 to 50 percent slopes, is in this unit. This soil is deep and well drained and has a cherty surface layer. It is a moderately steep to steep soil on uplands.

Natural fertility is medium. Available water capacity is low, and permeability is moderate. Runoff is rapid. The content of organic matter is moderate.

The major limitation to the use of this soil is the cherty surface layer, which causes this soil to be droughty and difficult to till. The hazard or erosion is also a limitation.

The use of this soil is restricted largely to pasture, wildlife habitat, and woodland. The removal of undesirable trees, protection from fire, and fencing to control or prevent grazing increase production of timber. Aerial spraying to control weeds, and brush, seeding, and fertilizing are useful management practices.

CAPABILITY UNIT VIIs–10

Only Rock land-Gasconade complex, 12 to 50 percent slopes, is in this unit. It is shallow and has many rock outcrops.

The soils in this unit are mostly covered with timber, scattered brush, and grass. Productivity is relatively low for either grasses or trees. Irregular topography and high rock content, plus the odd shape of some of the areas, prevent effective use of conventional grass or timber management practices. Controlled grazing and prevention of careless burning are the main management practices needed to secure optimum production of forage.

Predicted Yields

The predicted average yields per acre of the principal crops grown in Henry County under ordinary and improved management are given in table 2. All available sources of information on yields were used to make these estimates. The estimates are based on the observations of the soil scientists who made the survey, as well as on information obtained from local farmers, agronomists, public and private agencies, demonstration plots, and research data.

Management practices, weather conditions, plant diseases, and insect infestations vary from year to year and from place to place. Differences in any of these factors, especially in the droughts in summer, cause great fluctuations in crop production. Crop damage can also be heavy as a result of wind, hail, torrential rains, and flooding.

Columns A in table 2 give the predicted yields that can be expected, over a period of years, under a system of management practiced by most of the farmers growing the crop. The predictions are based on a combination of management practices commonly used by most of the farmers in the county. Crops are generally planted according to field boundaries. Only a small acreage of the land is terraced, and not all the fields are farmed on the contour. Wet areas are drained, but a better system of drainage commonly is needed. Lime and fertilizer are regularly used, but only about half the amount shown to be needed by soil tests is applied. Some farm operations are not so timely as desirable.

In columns B, predictions are based on a combination of improved management practices used by some of the farmers in the county. A systematic cropping plan consistent with the capability of the soils is followed. Sloping soils on uplands are terraced, and most soils that have a slope of more than 2 percent are farmed on the contour. Adequate drainage is installed as needed. Suitable varieties on plants that produce high yields are grown. Lime and fertilizer are regularly applied according to needs indicated by soil tests. Considerable attention is given to new methods of weed coontrol and management of crop residue. All farm operations are timely.

The yield predictions in table 2 are approximate figures and are intended to serve only as guides. Many users consider comparative yields among soils to be more valuable than actual yields. The relationship is likely to remain constant over a period of years.

Woodland [3]

In 1964 about 6 percent of the land area of Henry County, or 29,400 acres, was wooded. About 70 percent of the wooded area is used for grazing. The ungrazed areas are in relatively small tracts throughout most of the county. In the extreme southeast corner of the county, there is a predominantly wooded area that produces some merchantable timber.

It is estimated that about half of the acreage in the county that is in timber is on bottom lands. These areas occur throughout the county in narrow alluvial valleys and in wider stream valleys near the junction of South Grand River and Deepwater Creek. The soils in these valleys range from moderately well drained to poorly drained, and nearly all of the wooded areas are subject to flooding. Major species of trees in these areas are white oak, black oak, pin oak, black walnut, eastern cottonwood, sycamore, and green ash.

The rest of the woodland in the county is on uplands, mainly in areas of Bolivar, Crider, Goss, and Mandeville soils and of the Bolivar-Rock land and Rock land-Gasconade complexes. The densest stands of timber are in areas of Goss and Crider soils in the southeast corner of the county. Scattered tracts are in areas of Bolivar and Mandeville soils and on the soils in complexes with Rock land, mainly in the northern and eastern parts of the country.

The soils on uplands where there are stands of timber generally have sandstone, chert, or shale bedrock within a depth of 20 to 40 inches. The Goss soils have a cherty surface layer. The soils in complexes with Rock land have a restricted rooting zone. The low available moisture capacity and limited rooting zone are the main limitations to the growth of trees on these sites. Major species of trees found in the existing tracts of timber on uplands are red oak, white oak, and eastern redcedar.

Mine pits and dumps occur in large areas and make up more than 13,000 acres. This acreage is increasing as more acres in the county are mined. Scattered trees and shrubs are invading some of these sites, but until the sites are leveled or modified for planting, the encroachment of timber is expected to be slow. The potential for timber production exists, however, and shortleaf pine and European black alder appear to be the most suitable species.

Woodland suitability groups

The soils that are now in trees, or that have a potential for use as woodland, are placed in woodland suitability groups and described in table 3.

Each woodland group is identified by a three-part symbol, such as 3o4, 4w6, or 4t9. The first part of the symbol is a number that indicates relative potential productivity of the soils in the group: 1 means very high; 2 means high; 3 means moderately high; 4 means moderate; and 5 means low. These ratings are based on site index, which is the height, in feet, that the dominant trees of a given species reach in a natural, unmanaged stand in a specific number of years. For cottonwood trees the site index is the height reached in 30 years, but for the other merchantable trees in the county the index is based on 50 years.

The site index of the trees that commonly grow in Henry County has not been measured, but estimates of these indexes are a part of table 3. These estimates are based on average values for the same or similar soils reported in the Soil Survey Interpretations for Woodlands in the Boston Mountains and Arkansas Valleys and Ridges of Arkansas and Oklahoma (*11*). The site index estimate for the strip-mined areas is based on estimates by the author and on observations of similar areas.

The second part of the symbol is a small letter. It indicates an important soil property that imposes a slight to severe hazard or limitation on the management of the soils for wood crops. A letter *w* shows that water in or on the soil, either seasonally or year round, is the chief limitation; *t* indicates soils that have a toxic substance that influences tree growth; *d* shows soils that have restrictions for woodland use because of limited rooting depth; and *o* shows soils that have few limitations that restrict their use for trees. Some soils may have more than one set of characteristics. Priority in placing the soils into a subclass is in the order that the characteristics are listed above.

The third part of the symbol is a number that indicates the degree of hazard or limitation and the general suitability of the soils for certain kinds of trees.

The numeral *1* indicates the soils have few, if any, limitations and are suited to coniferous trees.

The numeral *2* indicates the soils have one or more moderate limitations and are suited to coniferous trees.

The numeral *3* indicates the soils have one or more severe limitations and are suited to coniferous trees.

The numeral *4* indicates the soils have few, if any, limitations and are suited to deciduous trees.

The numeral *5* indicates the soils have one or more moderate limitations and are suited to deciduous trees.

The numeral *6* indicates the soils have one or more severe limitations and are suited to deciduous trees.

[3] FRANCIS T. HOLT, forester, Soil Conservation Service, assisted in the preparation of this section.

TABLE 2.—*Predicted average yields per acre of the principal crops under two levels of management*

[Yields in columns A are those to be expected under ordinary management, and yields in columns B are those to be expected under improved management. Absence of a yield figure indicates that the soil generally is not suited to the crop]

Soil	Corn		Wheat		Soybeans		Sorghum (grain)		Alfalfa		Tall fescue	
	A	B	A	B	A	B	A	B	A	B	A	B
	Bu	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Tons*	*Tons*	*Tons*	*Tons*
Barco loam, 2 to 5 percent slopes	45	65	27	40	22	35	25	40	2.6	4.0	1.0	2.6
Barco loam, 2 to 5 percent slopes, eroded	35	58	23	34	17	31	23	36	2.2	3.4	.9	2.1
Barco loam, 5 to 10 percent slopes	32	55	22	32	17	30	22	35	2.6	4.0	1.0	2.5
Barco loam, 5 to 10 percent slopes, eroded	30	48	18	30	12	20	15	30	2.0	3.0	.9	2.0
Barco loam, 5 to 15 percent slopes, severely eroded									1.0	2.0	.5	1.5
Barco loam, 10 to 20 percent slopes, eroded											.6	1.7
Bolivar fine sandy loam, 2 to 5 percent slopes	45	55	27	35	20	30	25	40	3.0	4.0	1.0	2.5
Bolivar fine sandy loam, 2 to 5 percent slopes, eroded	30	50	20	30	15	25	20	35	2.2	3.5	.9	2.0
Bolivar fine sandy loam, 5 to 10 percent slopes, eroded	25	40	20	30			20	30	2.2	3.5	.9	2.0
Bolivar fine sandy loam, 10 to 25 percent slopes, eroded									1.5	2.5	.7	1.7
Bolivar-Rock land complex, 2 to 15 percent slopes											.5	1.5
Bolivar-Rock land complex, 15 to 50 percent slopes											.5	1.0
Cherokee silt loam, 1 to 3 percent slopes	35	55	20	35	20	30	20	35	2.0	3.0	.8	2.4
Cherokee silt loam, 1 to 3 percent slopes, eroded	15	45	15	20	15	20	20	25	1.0	1.5	.5	1.5
Coweta fine sandy loam, 2 to 10 percent slopes									.5	1.0	.7	1.4
Coweta fine sandy loam, 10 to 25 percent slopes											.6	1.3
Creldon silt loam, 2 to 5 percent slopes	35	60	25	37	20	35	24	35	2.0	3.5	.9	2.5
Creldon silt loam, 5 to 10 percent slopes	35	55	20	35	20	30	20	30	2.0	3.5	.9	2.5
Crider silt loam, 2 to 5 percent slopes	55	75	30	40	25	35	25	40	3.0	5.0	1.2	2.7
Crider silt loam, 2 to 5 percent slopes, eroded	45	65	25	32	20	30	20	30	2.5	4.5	1.0	2.5
Crider silt loam, 5 to 15 percent slopes, eroded	35	55	20	26	15	25	18	25	2.3	4.0	1.0	2.3
Deepwater silt loam, 2 to 5 percent slopes	50	85	27	40	27	45	25	42	3.4	4.5	1.5	2.8
Deepwater silt loam, 2 to 5 percent slopes, eroded	40	75	22	34	18	32	22	36	2.5	4.0	1.2	2.2
Deepwater silt loam, 5 to 10 percent slopes	40	65	25	33	18	30	20	35	2.2	3.5	1.0	2.5
Deepwater silt loam, 5 to 10 percent slopes, eroded	30	50	20	30	12	20	20	30	1.5	2.5	.8	1.8
Deepwater silty clay loam, 2 to 5 percent slopes, severely eroded	25	40	18	25	10	18	15	25	1.0	2.2	0	1.2
Deepwater silty clay loam, 5 to 10 percent slopes, severely eroded	25	35	18	25	10	18	15	25	1.0	2.2	.6	1.2
Eldon cherty silt loam, 2 to 5 percent slopes	25	40	22	33	15	22	15	30	2.0	3.5	1.0	2.2
Eldon cherty silt loam, 5 to 10 percent slopes	20	30	20	30	12	20	12	22	1.5	2.5	1.0	2.2
Eldon cherty silt loam, 10 to 20 percent slopes									1.0	2.0	.8	1.7
Goss cherty silt loam, 2 to 15 percent slopes			25	30	20	25	25	30	2.0	3.0	1.2	2.0
Goss cherty silt loam, 15 to 50 percent slopes											1.0	1.8
Hartwell silt loam, 0 to 2 percent slopes	45	70	28	40	24	35	25	36	1.5	2.5	1.0	2.5
Hartwell silt loam, 2 to 4 percent slopes	40	65	28	40	24	35	25	36	1.5	2.5	1.0	2.5
Hartwell silt loam, 2 to 5 percent slopes, eroded	30	46	20	25	19	27	22	31	1.0	2.0	.8	1.5
Hartwell silty clay loam, 2 to 5 percent slopes, severely eroded	20	35	15	20	12	25	15	25	.8	1.2	.8	1.2
Lightning silt loam	35	60	20	30	20	30	25	35			.8	1.5
Mandeville silt loam, 2 to 5 percent slopes	42	70	25	35	20	30	35	65	2.2	3.5	1.5	3.0
Mandeville silt loam, 5 to 10 percent slopes, eroded	30	50	20	25	12	20	20	35	1.5	2.5	.8	2.0
Mandeville silt loam, 10 to 25 percent slopes									1.5	2.0	1.0	2.5
Mine pits and dumps												
Muldrow silt loam	45	60	25	35	20	30	25	45	2.0	3.5	1.0	2.5
Newtonia silt loam, 1 to 3 percent slopes	55	75	30	40	30	35	40	60	3.4	5.0	1.2	2.7
Norris shaly loam, 10 to 25 percent slopes, eroded											.8	1.2
Osage silty clay loam	50	75	26	35	22	35	25	80	1.5	2.5	1.2	2.5
Osage silty clay loam, high bottom	50	75	26	35	22	35	25	70	1.5	2.5	1.2	2.5
Osage silty clay	40	60	22	30	20	30	20	65	1.0	2.0	1.0	2.0
Quarles silt loam	50	75	25	32	22	35	25	40	1.5	2.5	1.2	2.5
Rock land-Gasconade complex, 12 to 50 percent slopes												
Roseland silt loam, 2 to 10 percent slopes									.5	1.0	.6	1.0
Roseland silt loam, 10 to 15 percent slopes									.5	1.0	.6	1.0
Roseland shaly silt loam, 5 to 15 percent slopes, severely eroded											.5	.8
Snead silty clay, 2 to 5 percent slopes	40	60	25	30	22	35	15	45	2.5	3.5	1.2	2.6
Snead silty clay, 2 to 5 percent slopes, eroded	35	50	20	25	17	20	20	40	2.0	3.0	1.0	2.5
Snead silty clay, 5 to 15 percent slopes, eroded									1.0	2.0	1.0	2.5
Summit silty clay loam, 2 to 5 percent slopes	52	70	30	42	25	37	27	42	2.8	4.0	1.2	2.6
Summit silty clay loam, 2 to 5 percent slopes, eroded	40	55	20	30	17	25	20	30	2.0	3.0	1.0	2.5
Summit silty clay loam, 5 to 10 percent slopes	45	60	25	35	20	30	25	37	2.0	3.0	1.2	2.5

TABLE 2.—*Predicted average yields per acre of the principal crops under two levels of management*—Continued

Soil	Corn		Wheat		Soybeans		Sorghum (grain)		Alfalfa		Tall fescue	
	A	B	A	B	A	B	A	B	A	B	A	B
	Bu	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Tons*	*Tons*	*Tons*	*Tons*
Summit silty clay loam, 5 to 10 percent slopes, eroded	30	45	15	22	15	20	20	25	1.0	2.0	1.0	2.5
Urich silt loam	45	75	25	35	20	35	25	40	2.0	3.5	1.0	2.5
Verdigris silt loam	55	85	33	45	30	40	25	45	3.5	5.5	1.5	3.0

The numeral *7* indicates the soils have few, if any, limitations and are suited to either coniferous or deciduous trees.

The numeral *8* indicates the soils have one or more moderate limitations and are suited to either coniferous or deciduous trees.

The numeral *9* indicates the soils have one or more severe limitations and are suited to either coniferous or deciduous trees.

The hazards or limitations that affect the management of soils for woodland are seedling mortality, erosion hazard, windthrow hazard, plant competition, and equipment limitations. These terms are rated for each group shown in table 3 and are briefly defined in the following paragraphs.

Seedling mortality refers to the expected loss of seedlings after natural seeding or planting, as influenced by soil texture, depth, drainage, flooding, depth to the water table, and degree of erosion. A rating of *slight* indicates that the expected loss is less than 25 percent; *moderate* indicates that losses are between 25 and 50 percent; and *severe* indicates that losses are more than 50 percent.

Erosion hazard is rated according to the risk of erosion on wooded soils where normal practices are used in managing and harvesting trees. It is *slight* if erosion is not an important concern, *moderate* if some attention must be given to reduce soil losses, and *severe* if intensive, and generally expensive, measures must be taken to control erosion.

Windthrow hazard indicates the relative danger of trees being blown over by high winds that normally occur, excluding tornadoes. The hazard is *slight* if windthrow is of no special concern, and it is *moderate* if roots hold the trees firmly, except where the soil is excessively wet or when the wind is strongest.

Plant competition refers to the expected hazard from compteition by other plants. A rating of *slight* means that competition from other plants is not a special concern. A rating of *moderate* means that plant competition occurs but generally does not prevent an adequate stand from becoming established. A rating of *severe* means that plant competition prevents trees from restocking naturally.

Equipment limitations are based on the degree that soils and topographic features restrict or prohibit the use of equipment normally employed in tending a crop of trees. The limitation is *slight* if there is little or no restriction of the type of equipment that can be used or the time of year that equipment can be used. It is *moderate* if the use of equipment is seasonally limited or if modified equipment or methods of harvesting are needed. The limitation is *severe* if special equipment is needed or if the use of such equipment is severely restricted by one or more unfavorable soil characteristics. These unfavorable soil characteristics include drainage, slope, number or size of stones, and soil texture.

Wildlife

A wide variety and a large number of game and nongame birds, animals, and fish are in Henry County. Wildlife habitat suitable for open-land wildlife is in greatest supply and is the best distributed of the different kinds of habitat. Bobwhite quail, cottontail rabbits, mourning dove, fox squirrel, gray squirrel, and prairie chickens are the most important open-land wildlife. Bass, bluegill, and catfish are in the more than 5,000 acres of open water in the major streams, large mine pits, farm ponds, and reservoirs. Mink, muskrats, raccoon, and beaver, the important furbearers, also live close to these waters. White-tailed deer are increasing in number, especially in the areas interspersed with trees and crops near the larger streams.

Planning for maximum use and production of the soils for wildlife requires that certain areas be designated for production or preservation of wildlife habitat. This means that management must involve the establishment and maintenance of the kind of habitat that is either absent or in short supply. Most of the wildlife is in areas of soils mainly used for grain, hay, pasture, or forest. For example, the number of prairie chickens, jackrabbits, and other prairie birds and mammals is directly related to the extensive, but rapidly declining, acreage of native prairie in the county. As the acreage in native prairie declines, so does the number of animals dependent upon this type of habitat. Intensive wildlife management presently is limited to small acreages that are used specifically for producing food and cover for wildlife.

The soils of Henry County have been rated according to their limitations for the development of wildlife habitat. In rating the soils the soil characteristics and

TABLE 3.—*Woodland suitability groups, potential produc-*

Woodland suitability group	Potential productivity			Management hazards or limitations
	Species	Site index	Average annual growth per acre	Seedling mortality
			Bd ft Doyle rule	
Group 3o4: Moderately well drained, silty soils on bottom lands; subject to occasional overflow. Verdigris: Ve.	Upland oaks.	75	280	Slight
Group 4o7: Well-drained, silty and loamy soils on uplands; surface layer and subsoil are 20 to 60 inches deep over bedrock and have less than 50 percent chert fragments. For other mapping units of the Bolivar series, see group 5d9. Bolivar: BoB, BoB2, BoC2, BoD2, Crider: CsB, CsB2, CsC2; Goss: GoC, GoD; Mandeville: MaB, MaC2, MaD.	Upland oaks.	52	130	Slight
Group 4w6: Somewhat poorly drained and poorly drained, seasonally wet soils on bottom lands and terraces; subject to occasional ponding or flooding. Lightning: Ls; Muldrow: Mu; Osage: Os, Ot, Oy; Quarles: Qu; Urich: Ur.	Pin oak. Pecan.	75 50	820 ----	Severe Severe
Group 4t9: Strip-mined areas that are mixtures of shale, sandstone, and limestone materials. Mine pits and dumps: Mp.	Shortleaf pine.	[1] 55	170	Severe
Group 5d9: Silty and clayey soils on uplands; soils are less than 20 inches deep to bedrock and generally have rock or shale fragments in the surface layer. Bolivar: BrC, BrE; Norris: NoD2; Rock land-Gasconade complex: RgD; Roseland: RoC, RoD, RsD3.	Shortleaf pine.	[1] 50	170	Moderate to severe

[1] Although this species is nearly nonexistent in the county, data give an indication of the expected productivity.

qualities emphasized were effective depth, texture of the surface layer, natural drainage class, surface stoniness, flooding, slope gradient, permeability, and available water capacity. Important factors not considered were existing vegetation; present land use; size, shape, and location of areas; and the movement of wildlife from place to place.

The estimated degree and kind of limitations affecting the use of the soils for wildlife habitat are shown in table 4. The ratings provided are helpful in selecting the sites and planning and developing wildlife habitat. These ratings also indicate the limitations affecting the use of the soils for open-land, woodland, and wetland wildlife habitat.

A rating of *good* indicates that wildlife habitat generally is easily created, improved, or maintained, and that there are few or no soil limitations that affect wildlife habitat management. Satisfactory results can be expected. A rating of *fair* indicates that wildlife habitat generally can be created, improved, or maintained, but that there are moderate soil limitations that affect wildlife habitat management. Moderately intense management and fairly frequent attention are required to assure satisfactory results. A rating of *poor* indicates that wildlife habitat generally can be created, improved, or maintained on the soils, but that soil limitations are severe. Wildlife habitat management is difficult and expensive, or it requires intensive effort. A rating of *very poor* indicates that it is impractical to attempt to create, improve, or maintain wildlife habitat.

Most wildlife habitats are created, improved, or maintained by (1) planting suitable vegetation; (2) manipulating existing vegetation; (3) inducing natural establishment of desired plants; or (4) combinations of such measures. The seven elements of wildlife habitat rated in table 4 are discussed in the following paragraphs.

Grain and seed crops are annuals planted to produce food for wildlife. Included among these crops are corn, soybeans, wheat, oats, millet, and sorghum.

Domestic grasses and legumes are domestic perennial grasses and herbaceous legumes planted to provide wildlife cover and food. Examples of these plants are fescue, brome, timothy, redtop, orchardgrass, reed canarygrass, clover, trefoil, alfalfa, and lespedeza.

tivity, hazards and limitations, and suitable species

Management hazards or limitations—Continued				Suitable species—	
Erosion hazard	Windthrow hazard	Plant competition	Equipment limitations	To favor in existing stands	For planting
Slight	Slight	Moderate	Slight	Upland oaks, black walnut, green ash.	Black walnut, sweetgum, pecan, yellow-poplar.
Slight	Slight	Slight	Slight	Upland oaks	Shortleaf pine, green ash.
Moderate	Slight	Severe	Moderate	Pin oak, pecan	Pin oak, pecan.
Moderate	Slight	Severe	Moderate	Pin oak, pecan	Pin oak, pecan.
Severe	Slight	Slight	Moderate		Shortleaf pine.
Moderate to severe	Moderate	Slight	Moderate to severe	Redcedar	Shortleaf pine.

Wild herbaceous upland plants are native or introduced perennial grasses and weeds that provide food and cover for wildlife, principally wildlife on uplands, and are mainly established through natural processes. Examples of these plants are big bluestem, little bluestem, some panicums and other native grasses, partridge peas, beggarticks, various native lespedezas, and other native herbs.

Hardwood woodland plants are nonconiferous trees, shrubs, and woody vines that produce fruits, nuts, buds, catkins, twigs, or foliage used extensively as food by wildlife and which are commonly established through natural processes but may also be planted. Examples of these plants are dogwood, sumac, sassafras, persimmon, hazelnut, shrub lespedeza, wild cherry, autumn-olive, oaks, hickory, grape, plum, blackberry, blackhaw, honeysuckle, and roses.

Coniferous woodland plants are cone-bearing trees and shrubs that are important to wildlife primarily as cover, but that also furnish food in the form of browse, seeds, or fruitlike cones. Examples of these plants are Virginia pine, white pine, shortleaf pine, Scotch pine, red pine, and redcedar. The ratings for this habitat element are based on growth rate limitations that produce dense, low foliage and delayed canopy closure rather than on timber production.

Wetland food and cover plants are annual and perennial wild herbaceous plants in moist to wet sites, exclusive of floating or submerged aquatics. These plants produce food or cover that is mainly used by wetland forms of wildlife. Examples are smartweed, bulrush, barnyard grass, duckweed, pondweed, pickerelweed, cattail, and various sedges.

Shallow-water developments are impoundments or excavations for control of water that generally are not more than 5 feet deep. Examples are low dikes and levees; shallow dugouts, such as borrow pits along highways and levees; level ditches; and devices for waterlevel control in marshy streams or channels.

As shown in table 4, there are three main classes of wildlife. These classes are defined in the following paragraphs.

Open-land wildlife consists of birds and mammals that normally make their homes in crop fields, pastures, lawns, and areas overgrown by grasses, herbs, and shrubby plants. Examples of open-land wildlife

TABLE 4.—*Suitability of soils for elements*

Soil series and map symbols	Elements of wildlife habitat			
	Grain and seed crops	Domestic grasses and legumes	Wild herbaceous upland plants	Hardwood woodland plants
Barco:				
BaB, BaB2, BaC, BaC2	Fair: depth	Good	Good	Good
BaC3, BaD2	Fair: depth	Good	Good	Good
Bolivar:				
BoB, BoB2, BoC2, BrC	Fair: depth	Good	Good	Good
BoD2, BrE Rock land part of BrC and BrE is too variable to be rated.	Poor: slope	Fair: slope	Good	Good
Cherokee: ChB, ChB2	Fair: wetness	Good	Good	Good
Coweta:				
CoC	Poor: depth; available water capacity.	Poor: depth	Fair: depth; available water capacity.	Fair: depth
CoD	Poor: depth; available water capacity.	Poor: depth	Fair: depth; available water capacity.	Fair: depth
Creldon:				
CrB	Good	Good	Good	Good
CrC	Fair: slope	Good	Good	Good
Crider:				
CsB, CsB2	Good	Good	Good	Good
CsC2	Fair: slope	Good	Good	Good
Deepwater:				
DeB, DeB2, DpB3	Good	Good	Good	Good
DeC, DeC2, DpC3	Fair: slope	Good	Good	Good
Eldon:				
EIB	Good	Good	Good	Good
EIC	Fair: slope	Good	Good	Good
EID	Poor: slope	Fair: slope	Good	Good
Gasconade Mapped only in a complex with Rock land.	Very poor: available water capacity.	Poor: depth; available water capacity.	Poor: available water capacity.	Very poor: available water capacity.
Goss:				
GoC	Fair: available water capacity.	Good	Good	Good
GoD	Poor: slope	Fair	Good	Good
Hartwell:				
HtA	Fair: wetness	Good	Good	Good
HtB, HtB2, HyB3	Fair: wetness	Good	Good	Good
Lightning: Ls	Fair: wetness; flooding.	Fair: wetness; flooding.	Fair: wetness; flooding.	Fair: wetness
Mandeville:				
MaB, MaC2	Fair: depth	Good	Good	Good
MaD	Poor: slope	Fair: slope	Good	Good

of wildlife habitat and for classes of wildlife

Elements of wildlife habitat—Continued			Classes of wildlife		
Coniferous woodland plants	Wetland food and cover plants	Shallow-water developments	Open-land	Woodland	Wetland
Good	Poor: well drained; slope.	Very poor: well drained; slope.	Good	Good	Very poor.
Good	Very poor: slope	Very poor: well drained; slope.	Good	Good	Very poor.
Good	Poor: well drained; slope.	Very poor: well drained; slope.	Good	Good	Very poor.
Good	Very poor: slope	Very poor: well drained; slope.	Fair	Good	Very poor.
Good	Fair: drainage	Fair: drainage	Good	Good	Fair.
Fair: depth	Poor: well drained; slope.	Very poor: well drained; slope.	Poor	Fair	Very poor.
Fair: depth	Very poor: slope	Very poor: well drained; slope.	Poor	Fair	Very poor.
Good	Poor: drainage; slope.	Very poor: slope	Good	Good	Very poor.
Good	Poor: drainage; slope.	Very poor: slope	Good	Good	Very poor.
Good	Poor: drainage; slope.	Very poor: well drained; slope.	Good	Good	Very poor.
Good	Very poor: slope	Very poor: wel drained; slope.	Good	Good	Very poor.
Good	Poor: drainage	Poor: drainage; slope.	Good	Good	Poor.
Good	Poor: drainage	Very poor: slope	Good	Good	Very poor.
Good	Poor: well drained; slope.	Very poor: well drained; slope.	Good	Good	Very poor.
Good	Poor: well drained; slope.	Very poor: well drained; slope.	Good	Good	Very poor.
Good	Very poor: slope	Very poor: well drained; slope.	Fair	Good	Very poor.
Very poor: available water capacity.	Very poor: drainage; slope.	Very poor: drainage; slope.	Poor	Very poor	Very poor.
Good	Poor: well drained; slope.	Very poor: well drained; slope.	Good	Good	Very poor.
Good	Very poor: slope	Very poor: well drained; slope.	Fair	Good	Very poor.
Good	Fair: drainage	Fair: drainage; slope.	Good	Good	Fair.
Good	Fair: drainage	Poor: slope	Good	Good	Poor.
Fair: wetness	Good	Good	Fair	Fair	Good.
Good	Poor: well drained; slope.	Very poor: well drained; slope.	Good	Good	Very poor.
Good	Very poor: slope	Very poor: well drained; slope.	Fair	Good	Very poor.

TABLE 4.—*Suitability of soils for elements*

Soil series and map symbols	Elements of wildlife habitat			
	Grain and seed crops	Domestic grasses and legumes	Wild herbaceous upland plants	Hardwood woodland plants
Mine pits and dumps: Mp. Too variable to be rated.				
Muldrow: Mu	Fair: wetness	Good	Good	Good
Newtonia: NeB	Good	Good	Good	Good
Norris: NoD2	Very poor: available water capacity.	Poor: available water capacity; depth.	Poor: available water capacity.	Very poor: available water capacity.
Osage:				
Os, Ot	Fair: wetness; flooding.	Fair: wetness; flooding.	Fair: wetness; surface texture; flooding.	Fair: wetness
Oy	Fair: wetness; flooding.	Fair: wetness; flooding.	Fair: wetness; surface texture; flooding.	Fair: wetness
Quarles: Qu	Fair: wetness; flooding.	Fair: wetness; flooding.	Fair: wetness; flooding.	Fair: wetness
Rock land: RgD. Rock land part too variable to be rated. For Gasconade part, see Gasconade series.				
Roseland:				
RoC	Poor: available water capacity.	Fair: available water capacity.	Fair: available water capacity.	Fair: available water capacity.
RoD, RsD3	Poor: available water capacity.	Fair: available water capacity.	Fair: available water capacity.	Fair: available water capacity.
Snead:				
SnB, SnB2	Fair: depth; surface texture; available water capacity.	Fair: surface texture; available water capacity.	Fair: surface texture; available water capacity.	Fair: available water capacity.
SnC2	Fair: depth; surface texture; available water capacity.	Fair: surface texture; available water capacity.	Fair: surface texture; available water capacity.	Fair: available water capacity.
Summit:				
SuB, SuB2	Fair: wetness	Good	Good	Good
SuC, SuC2	Fair: wetness	Good	Good	Good
Urich: Ur	Fair: wetness; flooding.	Fair: wetness; flooding.	Fair: wetness; flooding.	Fair: wetness
Verdigris: Ve	Good	Good	Good	Good

are bobwhite quail, prairie chickens, meadowlarks, field sparrows, redwing blackbirds, cottontail rabbits, jackrabbits, red foxes, and woodchuck.

Woodland wildlife consists of birds and mammals that normally make their homes in areas where there are hardwood trees and shrubs, coniferous trees and shrubs, or mixtures of such plants. Examples of woodland wildlife are thrushes, vireos, scarlet tanagers, doves, turkeys, squirrels, gray foxes, deer, and raccoons.

Wetland wildlife consists of birds and mammals that normally make their homes in wet areas such as ponds, marshes, and swamps. Examples of wetland wildlife are ducks, geese, herons, minks, muskrats, and raccoons.

Recreation

Knowledge of soils is necessary in planning, developing, and maintaining areas for recreation. In table 5

of wildlife and for classes of wildlife—Continued

Elements of wildlife habitat—Continued			Classes of wildlife		
Coniferous woodland plants	Wetland food and cover plants	Shallow-water developments	Open-land	Woodland	Wetland
Good	Fair: wetness	Fair: wetness	Good	Good	Fair.
Good	Poor: well drained	Very poor: well drained.	Good	Good	Very poor.
Very poor: available water capacity.	Very poor: slope	Very poor: well drained; slope.	Poor	Very poor	Very poor.
Fair: wetness	Good	Good	Fair	Fair	Good.
Fair: wetness	Poor: surface texture.	Good	Fair	Fair	Fair.
Fair: wetness	Good	Good	Fair	Fair	Good.
Fair: available water capacity.	Poor: well drained; slope.	Very poor: well drained; slope.	Fair	Fair	Very poor.
Fair: available water capacity.	Very poor: slope	Very poor: well drained; slope.	Fair	Fair	Very poor.
Fair: available water capacity.	Poor: surface texture; drainage.	Very poor: slope	Fair	Fair	Very poor.
Fair: available water capacity.	Very poor: slope	Very poor: slope	Fair	Fair	Very poor.
Good	Fair: wetness; slope.	Very poor: slope	Good	Good	Poor.
Good	Poor: slope	Very poor: slope	Good	Good	Very poor.
Fair: wetness	Good	Good	Good	Fair	Good.
Good	Poor: drainage	Poor: drainage	Good	Good	Poor.

the soils of Henry County are rated according to limitations that affect their suitability for camp areas, playgrounds, picnic areas, paths and trails, and golf fairways.

In table 5 the soils are rated as having *slight, moderate,* or *severe* limitations for the specified uses. For all of these ratings, it is assumed that a good cover of vegetation can be established and maintained. A limitation of *slight* means that soil properties are generally favorable and limitations are so minor that they can be overcome easily. A *moderate* limitation can be overcome or modified by planning, by design, or by special maintenance. A *severe* limitation means that costly soil reclamation, special design, intense maintenance, or a combination of these, is required.

Camp areas are used intensively for tents and small camp trailers and the accompanying activities of outdoor living. Little preparation of the site is required, other than shaping and leveling for tent and parking areas. Camp areas are subject to heavy foot traffic and

TABLE 5.—*Limitations of the soils for recreational uses*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions for referring to other series that appear in the first column of this table]

Soil series and map symbols	Camp areas	Playgrounds	Picnic areas	Paths and trials	Golf fairways
Barco:					
BaB, BaB2	Slight	Moderate: slope; moderately deep to bedrock.	Slight	Slight	Slight.
BaC, BaC2, BaC3	Moderate: slope	Severe: slope	Moderate: slope	Slight	Moderate: slope.
BaD2	Severe: slope	Severe: slope	Severe: slope	Moderate: slope	Moderate: slope.
*Bolivar:					
BoB, BoB2	Slight	Moderate: slope; moderately deep to bedrock.	Slight	Slight	Slight.
BoC2, BrC	Moderate: slope	Severe: slope	Moderate: slope	Slight	Moderate: slope.
BoD2, BrE. Rock land part is too variable to be rated.	Severe: slope	Severe: slope	Severe: slope	Moderate: slope	Severe: slope.
Cherokee: ChB, ChB2	Severe: wetness; very slow permeability.	Severe: wetness; very slow permeability.	Moderate: wetness Moderate: wetness	Moderate: wetness Moderate: wetness	Moderate: wetness. Moderate: wetness.
Coweta:					
CoC	Slight	Severe: shallow to bedrock.	Slight	Slight	Slight.
CoD	Moderate: slope	Severe: shallow to bedrock; slope.	Moderate: slope	Moderate: slope	Moderate: slope.
Creldon:					
CrB	Moderate: slow permeability.	Moderate: slow permeability; slope.	Slight	Slight	Slight.
CrC	Moderate: slow permeability.	Severe: slope	Moderate: slope	Slight	Moderate: slope.
Crider:					
CsB, CsB2	Slight	Moderate: slope	Slight	Slight	Slight.
CsC2	Moderate: slope	Severe: slope	Moderate: slope	Slight	Moderate: slope.
Deepwater:					
DeB, DeB2	Slight	Moderate: slope	Slight	Slight	Slight.
DpB3	Moderate: silty clay loam surface layer.	Moderate: slope; silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Slight.
DeC, DeC2	Moderate: slope	Severe: slope	Moderate: slope	Slight	Moderate: slope.
DpC3	Moderate: silty clay loam surface layer; slope.	Severe: slope; silty clay loam surface layer.	Moderate: slope; silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: slope.
Eldon:					
ElB, ElC	Moderate: coarse fragments.	Severe: coarse fragments.	Moderate: coarse fragments.	Moderate: coarse fragments.	Moderate: coarse fragments.
ElD	Severe: slope	Severe: coarse fragments.	Severe: slope	Moderate: coarse fragments; slope.	Moderate: coarse fragments; slope.
Gasconade. Mapped only in a complex with Rock land.	Severe: slope	Severe: slope	Severe: slope	Moderate where slope is less than 25 percent; coarse fragments. Severe where slope is more than 25 percent.	Severe: coarse fragments on surface; slope.
Goss:					
GoC	Moderate: coarse fragments; slope.	Severe: coarse fragments; slope.	Moderate: coarse fragments; slope.	Slight	Severe: coarse fragments on surface.

TABLE 5.—*Limitations of the soils for recreational uses*—Continued

Soil series and map symbols	Camp areas	Playgrounds	Picnic areas	Paths and trails	Golf fairways
GoD	Severe: slope	Severe: coarse fragments; slope.	Severe: slope	Moderate where slope is less than 25 percent. Severe where slope is more than 25 percent.	Severe: coarse fragments on surface.
Hartwell: HtA, HtB, HtB2, HyB3.	Severe: wetness	Severe: wetness	Moderate: wetness	Moderate: wetness	Moderate: wetness.
Lightning: Ls	Severe: wetness; very slow permeability; subject to flooding.	Severe: wetness; very slow permeability; subject to flooding.	Severe: wetness; subject to flooding.	Severe: wetness	Severe: wetness.
Mandeville:					
MaB	Slight	Moderate: slope; moderately deep to bedrock.	Slight	Slight	Slight.
MaC2	Moderate: slope	Severe: slope	Moderate: slope	Slight	Moderate: slope.
MaD	Severe: slope	Severe: slope	Severe: slope	Moderate: slope	Moderate: slope.
Mine pits and dumps: Mp. Too variable to be rated.					
Muldrow: Mu	Severe: very slow permeability; subject to flooding.	Severe: very slow permeability; subject to flooding.	Moderate: wetness	Moderate: wetness	Moderate: subject to flooding.
Newtonia: NeB	Slight	Moderate: slope	Slight	Slight	Slight.
Norris: NoD2	Moderate where slope is less than 15 percent. Severe where slope is more than 15 percent.	Severe: slope	Moderate where slope is less than 15 percent. Severe where slope is more than 15 percent.	Moderate: slope; coarse fragments.	Severe: coarse fragments.
Osage: Os, Ot, Oy	Severe: wetness; very slow permeability; subject to flooding.	Severe: wetness; very slow permeability; subject to flooding.	Severe: wetness; subject to flooding.	Severe: wetness	Severe: wetness; subject to flooding.
Quarles: Qu	Severe: wetness; subject to flooding.	Severe: wetness; subject to flooding.	Severe: wetness; subject to flooding.	Severe: wetness	Severe: wetness; subject to flooding.
*Rock land: RgD. Rock land part too variable to be rated. For Gasconade part, see Gasconade series.					
Roseland:					
RoC	Slight	Moderate: slope	Slight	Slight	Severe: coarse fragments.
RoD	Moderate: slope	Severe: slope	Moderate: slope	Slight	Severe: coarse fragments.
RsD3	Moderate: slope; coarse fragments.	Severe: slope; coarse fragments.	Moderate: slope; coarse fragments.	Moderate: coarse fragments.	Severe: coarse fragments.
Snead: SnB, SnB2, SnC2	Severe: silty clay surface layer.	Severe: silty clay surface layer.	Severe: silty clay surface layer.	Severe: silty clay surface layer.	Moderate: silty clay surface layer.
Summit:					
SuB, SuB2	Moderate: wetness; slow permeability; silty clay loam surface layer.	Moderate: wetness; slow permeability; silty clay loam surface layer; slope.	Moderate: wetness; silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Slight.

TABLE 5.—*Limitations of soil for recreational uses* Continued

Soil series and map symbols	Camp areas	Playgrounds	Picnic areas	Paths and trails	Golf fairways
SuC, SuC2	Moderate: wetness; slow permeability; silty clay loam surface layer.	Severe: slope	Moderate: wetness; silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Slight.
Urich: Ur	Severe: wetness; subject to flooding.	Severe: wetness; subject to flooding.	Severe: wetness; subject to flooding.	Severe: wetness	Severe: wetness; subject to flooding.
Verdigris: Ve	Severe: wetness; subject to flooding.	Moderate: wetness; subject to flooding.	Moderate: wetness; subject to flooding.	Slight	Moderate: subject to flooding.

limited vehicular traffic. The most suitable soils have mild slopes, good drainage, a surface free of rocks and coarse fragments, freedom from flooding during periods of heavy use, and a surface that is firm after rains but not dusty when dry.

Playgrounds are areas used intensively for baseball, football, badminton, and similar organized games. Soils suitable for this use need to withstand intensive foot traffic. The most suitable soils have a nearly level surface that is free of coarse fragments and rock outcrops and is firm after rains but not dusty when dry, have good drainage, and are free from flooding during periods of heavy use. If grading and leveling are required, then depth to rock is important.

Picnic areas are attractive natural or landscaped tracts used primarily for preparing meals and eating outdoors. These areas are subject to heavy foot traffic. Most of the vehicular traffic, however, is confined to access roads. The most suitable soils are firm when wet but not dusty when dry; are free of flooding during the season of use; and do not have a slope or stoniness that greatly increases cost of leveling sites or of constructing access roads.

Paths and trails are used for local and cross-country travel by foot or horseback. Design and layout should require little or no cutting and filling. The most suitable soils are at least moderately well drained, are firm when wet but not dusty when dry, are flooded not more than once during the season of use, have a slope of less than 15 percent and have few, if any, rocks or stones on the surface.

Golf fairways are subject to heavy foot traffic. The most suitable soils are firm when wet but not dusty when dry, are free of flooding during the season of use, and have a surface that is free of rocks and coarse fragments. The soils should be well suited to grass.

Engineering Uses of the Soils [4]

This section is useful to those who need information about soils used as structural material or as foundation upon which structures are built. Among those who can benefit from this section are planning commissions, town and city managers, land developers, engineers, contractors, and farmers.

Among properties of soils highly important in engineering are permeability, strength, compaction characteristics, soil drainage condition, shrink-swell potential, grain size, plasticity, and soil reaction. Also important are depth to the water table, depth to bedrock, and soil slope. These properties, in various degrees and combinations, affect construction and maintenance of roads, airports, pipelines, foundations for small buildings, irrigation systems, ponds and small dams, and systems for disposal of sewage and refuse.

Information in this section of the soil survey can be helpful to those who—

1. Select potential residential, industrial, commercial, and recreational areas.
2. Evaluate alternate routes for roads, highways, pipelines, and underground cables.
3. Seek sources of gravel, sand, or clay.
4. Plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for controlling water and conserving soil.
5. Correlate performance of structures already built with properties of the kinds of soil on which they are built, for the purpose of predicting performance of structures on the same or similar kinds of soil in other locations.
6. Predict the trafficability of soils for cross-country movement of vehicles and construction equipment.
7. Develop preliminary estimates pertinent to construction in a particular area.

Most of the information in this section is presented in tables 6 and 7, which show, respectively, several estimated soil properties significant to engineering and interpretations for various engineering uses.

This information, along with the soil map and other parts of this publication, can be used to make interpretations in addition to those given in tables 6 and 7, and it also can be used to make other useful maps. This information, however, does not eliminate the need for further investigations at sites selected for en-

[4] PHILLIP D. COOMBS, assistant state conservation engineer, Soil Conservation Service, assisted in the preparation of this section.

gineering works, especially works that involve heavy loads or that require excavations to depths greater than those shown in the tables, generally depths greater than 6 feet. Also, inspection of sites, especially the small ones, is needed because many delineated areas of a given soil mapping unit may contain small areas of other kinds of soil that have strongly contrasting properties and different suitabilities or limitations for soil engineering.

Some of the terms used in this soil survey have special meaning to soil scientists that is not known to all engineers. The "Glossary" defines many of these terms commonly used in soil science.

Engineering soil classification systems

The two systems most commonly used in classifying samples of soils for engineering are the Unified system (*12*), used by the SCS engineers, Department of Defense, and others, and the AASHO system (*1*), adopted by the American Association of State Highway Officials.

In the Unified system soils are classified according to particle-size distribution, plasticity, liquid limit, and organic-matter content. Soils are grouped in 15 classes. There are eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes are designated by symbols for both classes; for example, ML-CL.

The AASHO system is used to classify soils according to those properties that affect use in highway construction and maintenance. In this system, a soil is placed in one of seven basic groups ranging from A–1 through A–7 on the basis of grain-size distribution, liquid limit, and plasticity index. In group A–1 are gravelly soils of high bearing strength, or the best soils for subgrade (foundation). At the other extreme, in group A–7, are clay soils that have low strength when wet and that are the poorest soils for subgrade. Where laboratory data are available to justify a further breakdown, the A–1, A–2, and A–7 groups are divided as follows: A–1–a, A–1–b, A–2–4, A–2–5, A–2–6, A–2–7, A–7–5, and A–7–6. As additional refinement, the engineering value of a soil material can be indicated by a group index number. Group indexes range from 0 for the best material to 20 or more for the poorest. The estimated AASHO classification, without group index numbers, is given in table 6 for all soils mapped in the survey area.

Engineering properties

Several estimated soil properties significant to engineering are given in table 6 by soil layers. These estimates are based on field observations made in the course of mapping, on test data for these and similar soils, and on experience with the same kinds of soil in other counties.

Depth to bedrock is the distance from the surface of the soil to a rock layer within the depth of observation.

Depth to seasonal high water table is the distance from the surface of the soil to the highest level that the ground water reaches in the soil in most years.

Soil texture is described in table 6 in the standard terms used by the Department of Agriculture (*9*). These terms are based on the percentages of sand, silt, and clay in the fraction of the soil consisting of particles less than 2 millimeters in diameter. "Loam," for example, is soil material that contains 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the soil contains gravel or other particles coarser than sand, an appropriate modifier is added, as for example, "gravelly loamy sand." "Sand," "silt," "clay," and some of the other terms used in USDA textural classification are defined in the "Glossary" of this soil survey.

Liquid limit and plasticity index are moisture contents obtained by specified operations. As the water content of a clayey soil, from which the particles coarser than 0.42 millimeter have been removed, is increased from a dry state, the material changes from a semisolid to a plastic state. If the moisture content is further increased, the material changes from a plastic to a liquid state. The plastic limit is the moisture content at which the soil material changes from a semisolid to a plastic state; and the liquid limit, from a plastic to a liquid state. The plasticity index is the numerical differences between the liquid limit and the plastic limit. It indicates the range of water content within which a soil material is plastic. Liquid limit and plasticity index are estimated in table 6.

Permeability, as used here, is an estimate of the rate at which saturated soil would transmit water in a vertical direction under a unit head of pressure. It is estimated on the basis of those soil characteristics observed in the field, particularly structure, porosity, and texture. Lateral seepage or such transient soil features as plowpans and surface crusts are not considered.

Available water capacity is an estimate of the capacity of soils to hold water for use by most plants. It is defined here as the difference between the amount of water in the soil at field capacity and the amount at the wilting point of most plants.

Reaction refers to the acidity or alkalinity of a soil, expressed in pH values for a stated soil-solution mixture. The pH value and terms used to describe soil reaction are explained in the "Glossary."

Shrink-swell potential refers to the relative change in volume to be expected of soil material with changes in moisture content; that is, the extent to which the soil shrinks as it dries out or swells when it gets wet. The extent of shrinking and swelling of soils may damage building foundations, roads, and other structures. Soils having a *high* shrink-swell potential are the most hazardous. Shrink-swell potential is not indicated for organic soils or for certain soils which shrink markedly on drying but do not swell quickly when rewetted.

Corrosivity, as used in table 6, pertains to potential soil-induced chemical action that dissolves or weakens steel or concrete. Rate of corrosion of steel is related to soil properties such as drainage, texture, total acidity, and electrical conductivity of the soil material. In-

TABLE 6.—*Estimated soil properties*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils in such to other series that appear in the first column of this table. The symbol < means less than;

Soil series and map symbols	Depth to— Bedrock	Depth to— Seasonal high water table	Depth from surface	Classification: Dominant USDA texture	Classification: Unified	Classification: AASHO
	Feet	*Feet*	*Inches*			
Barco: BaB, BaB2, BaC, BaC2, BaC3, BaD2.	1½–3½	>6	0–18	Loam	ML or CL	A–4
			18–39	Clay loam	CL	A–6
			39–60	Weathered sandstone.		
*Bolivar: BoB, BoB2, BoC2, BoD2, BrC, BrE. Rock land part of BrC and BrE is too variable to be rated.	1½–3½	>6	0–12	Fine sandy loam	ML, CL, SC, or SM	A–4
			12–39	Clay loam	CL or SC	A–6
			39–48	Weathered sandstone.		
			48	Sandstone bedrock.		
Cherokee: ChB, ChB2	>6	[1] 0–1½	0–10	Silt loam	ML or CL	A–4 or A–6
			10–26	Clay and silty clay	CH or CL	A–7
			26–60	Silty clay loam	CH or CL	A–7
Coweta: CoC, CoD	1–1½	>6	0–12	Fine sandy loam	CL, ML, SC, or SM	A–4
			12–18	Fine sandy loam	SM	A–2, A–4, or A–6
			18	Bedrock.		
Creldon: CrB, CrC	>6	[2] 1½–3½	0–12	Silt loam	ML	A–4
			12–29	Silty clay loam	CL	A–7
			[3] 29–37	Cherty silt loam (fragipan)	CL, SC, or GC	A–6 or A–2
			37–60	Clay	CH or SC	A–7
Crider: CsB, CsB2, CsC2	>6	>6	0–12	Silt loam	ML	A–4
			12–27	Silty clay loam	CL	A–7
			27–60	Clay loam	CL	A–6
Deepwater: DeB, DeB2, DeC, DeC2, DpB3, DpC3.	>6	3–6	0–18	Silt loam and silty clay loam	CL	A–4 or A–6
			18–60	Silty clay loam	CL	A–6 or A–7
Eldon: ElB, ElC, ElD	>6	>6	0–17	Cherty silt loam	GM	A–4 or A–2
			17–24	Cherty silty clay loam	CL or GC	A–7 or A–2
			24–60	Cherty clay	CH or GC	A–7 or A–2
Gasconade. Mapped only in a complex with Rock land.	1–1½	>6	0–7	Flaggy clay loam	CL	A–6
			7–14	Flaggy clay	GC	A–2
			14	Bedrock.		
Goss: GoC, GoD	>5	>6	0–23	Cherty silt loam	GM	A–4 or A–2
			23–64	Cherty clay	GC	A–7 or A–2
			64	Bedrock.		
Hartwell: HtA, HtB, HtB2, HyB3	>6	[1] 0–1½	0–15	Silt loam and silty clay loam	ML–CL or CL	A–4 or A–6
			15–28	Clay	CH or CL	A–7
			28–42	Silty clay loam	CL	A–6 or A–7
			42–60	Silt loam	CL	A 6
Lightning: Ls	>6	[4] 0–1½	0–12	Silt loam	ML or CL	A–4 or A–6
			12–43	Silty clay	CH or CL	A–7
			43–60	Silty clay loam	CH or CL	A 7

See footnotes at end of table.

significant to engineering

mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions for referring the symbol > means more than. Absence of data indicates that no estimate was made]

Percentage less than 3 inches passing sieve—				Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Shrink-swell potential	Corrosivity to—	
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)			*Inches per hour*	*Inches per inch of soil*	*pH value*		Uncoated steel	Concrete
100	97–100	75–90	60–75	22–30	2–8	0.6–2.0	0.20–0.22	5.1–6.0	Low	Low	Moderate.
85–100	85–100	80–98	60–72	30–38	10–20	0.6–2.0	0.15–0.19	5.1–6.0	Moderate	Moderate	Moderate.
100	90–100	70–95	40–55	20–24	4–9	2.0–6.0	0.16–0.18	5.1–6.0	Low	Low	Moderate.
90–100	90–100	70–95	35–60	26–30	10–18	0.6–2.0	0.15–0.19	4.5–5.5	Low	Moderate	Moderate.
100	100	90–100	70–90	20–35	1–15	0.6–2.0	0.22–0.24	5.1–6.5	Low	High	Low to moderate.
100	100	95–100	80–95	45–60	20–35	<0.06	0.09–0.13	4.5–5.5	High	High	Moderate to high.
100	100	95–100	85–95	40–55	15–30	0.06–0.2	0.09–0.13	5.1–5.5	Moderate to high.	High	Moderate.
90–100	90–100	70–85	36–55	20–24	4–9	2.0–6.0	0.10–0.18	5.6–6.0	Low	Low	Moderate.
60–70	60–70	60–70	25–50	22–28	6–15	0.6–2.0	0.09–0.16	5.1–5.5	Low	Low	High.
100	100	90–100	70–90	23–27	2–5	0.6–2.0	0.22–0.24	5.1–5.5	Low	Moderate	Moderate.
100	100	95–100	85–95	45–50	24–30	0.2–0.6	0.10–0.16	4.5–5.5	Moderate	High	Moderate to high.
35–75	35–75	30–65	20–55	30–40	10–20	0.06–0.2		5.6–6.0	Moderate	Moderate	Moderate.
55–75	50–70	40–70	40–60	60–65	30–40	0.2–0.6		5.6–6.5	Moderate	High	Low to moderate.
100	100	90–100	70–90	23–27	2–5	0.6–2.0	0.22–0.24	5.6–6.0	Low	Low	Moderate.
100	100	95–100	85–95	45–50	24–30	0.6–2.0	0.18–0.20	5.1–6.0	Moderate	Moderate	Moderate.
90–100	90–100	90–100	70–80	30–38	10–20	0.6–2.0	0.14–0.16	5.1–6.0	Moderate	Moderate	Moderate.
100	100	90–100	70–95	22–45	7–20	0.6–2.0	0.21–0.24	5.6–7.3	Low to moderate.	Moderate to high.	Low to moderate.
100	100	95–100	85–95	35–50	22–26	0.6–2.0	0.18–0.20	5.1–6.5	Moderate	High	Low to moderate.
40–70	30–60	25–55	15–50	20–30	2–8	2.0–6.0	0.05–0.10	4.5–7.3	Low	Low	Low to high.
45–60	35–60	30–60	20–55	40–50	24–30	0.6–2.0	0.04–0.07	4.5–5.0	Moderate	Moderate	High.
45–70	35–70	30–65	30–60	50–80	30–45	0.6–2.0	0.09–0.11	4.5–6.0	Moderate	High	Moderate to high.
70–85	70–85	60–75	55–65	30–40	15–25	0.6–2.0	0.11–0.17	6.6–7.3	Moderate	High	Low.
40–50	40–50	30–40	20–35	55–65	35–45	0.2–0.6	0.03–0.06	7.4–7.8	Moderate	High	Low.
40–70	30–60	25–55	15–40	15–25	2–8	2.0–6.0	0.06–0.17	5.1–6.0	Low	Low	Moderate.
45–70	40–65	35–60	30–50	50–70	30–40	0.6–2.0	0.02–0.08	5.1–6.0	Moderate	Moderate	Moderate.
100	100	90–100	70–92	24–32	6–11	0.2–2.0	0.21–0.24	5.6–6.0	Low to moderate.	High	Moderate.
100	100	95–100	90–100	45–60	30–40	0.06–0.2	0.09–0.11	5.6–6.0	High	High	Moderate.
100	100	95–100	90–100	35–45	20–25	0.06–0.2	0.09–0.13	6.6–7.3	Moderate	High	Low.
100	100	90–100	70–90	25–35	10–15	0.6–2.0	0.13–0.18	6.6–7.3	Low	High	Low.
100	100	95–100	85–100	25–40	3–15	0.6–2.0	0.22–0.24	4.5–7.3	Low	High	Low to high.
100	100	95–100	90–100	45–60	20–35	<0.06	0.11–0.13	4.5–5.0	High	High	High.
100	100	95–100	90–100	40–55	15–30	0.06–0.2	0.18–0.20	5.6–6.0	Moderate	High	Moderate.

TABLE 6.—*Estimated soil properties*

Soil series and map symbols	Depth to—		Depth from surface	Classification		
	Bedrock	Seasonal high water table		Dominant USDA texture	Unified	AASHO
	Feet	*Feet*	*Inches*			
Mandeville: MaB, MaC2, MaD	1½–3½	>6	0–26	Silt loam	ML or CL	A-4
			26–36	Loam	CL	A-6
			36–60	Weathered shale.		
Mine pits and dumps: Mp. Too variable to be estimated.						
Muldrow: Mu	>6	[4] 1½–3½	0–14	Silt loam	ML or CL	A-4 or A-6
			14–60	Silty clay loam	CH or CL	A-6 or A-7
Newtonia: NeB	>6	>6	0–14	Silt loam	ML or CL	A-4 or A-6
			14–24	Silty clay loam	ML or CL	A-4, A-6, or A-7
			24–60	Silty clay and clay	CH or CL	A-7
Norris: NoD2	1–1½	>6	0–11	Shaly loam	ML, CL, SM, or SC	A-4
			11–60	Weathered bedrock.		
Osage: Os, Ot, Oy	>6	[4] 0–1½	0–20	Silty clay loam and silty clay	CH or CL	A-7
			20–60	Silty clay	CH or CL	A-7
Quarles: Qu	>6	[4] 0–1½	0–18	Silt loam	ML	A-4
			18–36	Silty clay	CH or CL	A-7
			36–60	Silty clay loam	CH or CL	A-7
*Rock land: RgD. Too variable to be estimated. For Gasconade part, see Gasconade series.						
Roseland: RoC, RoD, RsD3	2½–5	>6	0–12	Silt loam and shaly silt loam	ML, CL, GM, or GC	A-4
			12–56	Shaly silty clay loam	GC	A-2
			56	Weathered bedrock.		
Snead: SnB, SnB2, SnC2	1½–3½	1½–3½	0–24	Silty clay	MH or CH	A-7
			24–60	Weathered shale.		
Summit: SuB, SuB2, SuC, SuC2	>6	1–3	0–7	Silty clay loam	CL or CH	A-6 or A-7
			7–19	Silty clay	CL or CH	A-6 or A-7
			19–60	Clay and silty clay	CL or CH	A-7
Urich: Ur	>6	[4] 0–1½	0–13	Silt loam	ML	A-4
			13–60	Silty clay loam	CH or CL	A-7
Verdigris: Ve	>6	[4] 1½–3½	0–60	Silt loam	CL	A-4 or A-6

[1] Seasonal perched water table above claypan.
[2] Seasonal perched water table above fragipan.

significant to engineering—Continued

Percentage less than 3 inches passing sieve—				Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Shrink-swell potential	Corrosivity to—	
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)							Uncoated steel	Concrete
						Inches per hour	*Inches per inch of soil*	*pH value*			
100	100	90–100	80–95	22–29	3–8	0.6–2.0	0.22–0.24	5.1–6.5	Low	Low	Low to moderate.
100	100	85–95	80–95	32–38	12–18	0.6–2.0	0.17–0.19	5.1–5.5	Low	Low	Moderate.
100	100	95–100	80–98	25–40	3–20	0.6–2.0	0.22–0.24	6.1–6.5	Low	High	Low.
100	100	95–100	85–99	35–65	15–35	<0.06	0.18–0.20	6.1–7.3	Moderate	High	Low.
100	100	90–100	70–90	20–35	1–12	0.6–2.0	0.22–0.24	5.6–6.0	Low	Low	Moderate.
100	100	95–100	85–95	30–50	8–20	0.6–2.0	0.18–0.20	5.1–5.5	Moderate	Moderate	Moderate.
100	100	95–100	90–98	40–65	15–35	0.6–2.0	0.08–0.12	5.1–6.0	High	Moderate	Moderate.
75–95	65–85	60–80	40–55	15–25	2–8	0.6–2.0	0.05–0.10	5.1–5.5	Low	Low	Moderate.
100	100	95–100	90–100	40–60	15–35	0.06–0.2	0.12–0.21	5.6–6.5	Moderate	High	Low to moderate.
100	100	95–100	95–100	50–80	25–50	<0.06	0.11–0.13	5.6–6.5	High	High	Low to moderate.
100	100	90–100	70–90	30–35	5–10	0.6–2.0	0.22–0.24	4.5–5.5	Low	High	Moderate to high.
100	100	95–100	90–95	45–65	20–35	0.06–0.2	0.11–0.13	4.5–5.5	High	High	Moderate to high.
100	100	95–100	85–95	40–55	15–35	0.06–0.2	0.18–0.20	5.6–6.5	Moderate	High	Low to moderate.
70–100	65–100	60–100	40–90	15–28	2–8	0.6–2.0	0.15–0.22	5.1–5.5	Low	Low	Moderate.
45–60	36–55	30–50	23–35	40–50	24–30	0.6–2.0	0.07–0.11	4.5–5.0	Moderate	Moderate	High.
90–100	90–100	90–100	85–100	50–65	20–35	0.06–0.2	0.12–0.14	7.4–7.8	High	High	Low.
100	100	98–100	90–98	35–60	13–35	0.2–0.6	0.21–0.23	6.6–7.3	Moderate	High	Low.
100	100	96–100	90–99	35–65	13–35	0.06–0.2	0.11–0.13	5.6–6.5	High	High	Low to moderate.
100	100	98–100	90–99	41–65	18–35	0.06–0.2	0.08–0.12	5.1–5.4	High	High	Low to moderate.
100	100	95–100	70–90	30–35	5–10	0.6–2.0	0.22–0.24	5.1–6.5	Low	High	Low to moderate.
100	100	95–100	70–80	45–60	20–35	0.06–0.2	0.18–0.20	5.1–6.5	High	High	Low to moderate.
100	100	95–100	70–90	25–35	8–18	0.6–2.0	0.20–0.24	6.1–6.5	Low to moderate.	Moderate	Low.

[3] Roots of most plants are excluded from these layers, and water is therefore not available to plants.
[4] Subject to flooding.

TABLE 7.—*Interpretations*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils in such to other series that appear in

Soil series and map symbols	Degree and kind of limitation for—				
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings without basements	Sanitary landfill
Barco: BaB, BaB2, BaC, BaC2, BaC3, BaD2.	Severe: sandstone at a depth of 20 to 40 inches.	Severe: sandstone at a depth of 20 to 40 inches; some lateral seepage.	Moderate: sandstone at a depth of 20 to 40 inches is rippable; clay loam.	Moderate: moderate shrink-swell potential.	Moderate: sandstone at a depth of 20 to 40 inches is rippable; moderate permeability; clay loam.
*Bolivar: BoB, BoB2, BoC2, BoD2, BrC, BrE. Rock land part of units BrC and BrE is too variable to be rated.	Severe: sandstone at a depth of 20 to 40 inches.	Severe: sandstone at a depth of 20 to 40 inches; some lateral seepage.	Generally moderate: sandstone at a depth of 20 to 40 inches is rippable; clay loam. Severe where slope is more than 15 percent.	Moderate: moderate shrink-swell potential.	Moderate: sandstone at a depth of 20 to 40 inches is rippable; moderate permeability; clay loam.
Cherokee: ChB, ChB2	Severe: very slow permeability; seasonal perched water table.	Slight [1]	Severe: somewhat poorly drained; seasonal perched water table; clay and silty clay subsoil.	Severe: seasonal perched water table.	Moderate: somewhat poorly drained; silty clay loam.
Coweta: CoC, CoD	Severe: sandstone at a depth of 10 to 20 inches.	Severe: sandstone at a depth of 10 to 20 inches.	Severe: sandstone at a depth of 10 to 20 inches.	Severe: sandstone at a depth of 10 to 20 inches.	Severe: sandstone at a depth of 10 to 20 inches.
Creldon: CrB, CrC	Severe: slow permeability; seasonal perched water table.	Moderate: slope [1]	Severe: seasonal perched water table.	Moderate: seasonal perched water table; moderate shrink-swell potential; plastic CL material.	Moderate: silty clay loam.
Crider: CsB, CsB2, CsC2	Moderate: moderate permeability.	Moderate where slope is 2 to 5 percent. Severe where slope is 5 to 15 percent.	Moderate: clay loam material.	Moderate: moderate shrink-swell potential; plastic CL material.	Slight
Deepwater: DeB, DeB2, DeC, DeC2, DpB3, DpC3.	Moderate: moderate permeability; seasonal water table at a depth of 3 to 6 feet.	Moderate: slope; seasonal water table at a depth of 3 to 6 feet; moderate permeability.	Moderate: moderately well drained; seasonal water table at a depth of 3 to 6 feet.	Moderate: moderate shrink-swell potential; plastic CL material.	Moderate: silty clay loam subsoil.
Eldon: ElB, ElC, ElD	Moderate: moderate permeability.	Moderate where slope is 2 to 10 percent. Severe where slope is 10 to 20 percent.	Moderate: cherty clay material.	Moderate: moderate shrink-swell potential; plastic CL material.	Moderate: cherty clay subsoil.

See footnote at end of table.

of engineering properties

mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions for referring the first column of this table]

Degree and kind of limitation for—Continued	Suitability as source of—		Soil features affecting—			
Local roads and streets	Road fill	Topsoil	Pond reservoir areas	Embankments, dikes, and levees	Drainage for crops and pasture	Terraces and diversions
Generally moderate: moderate shrink-swell potential. Severe where slope is more than 15 percent.	Fair: moderate shrink-swell potential.	Good where slope is 2 to 10 percent. Fair where slope is more than 10 percent.	Moderate permeability; sandstone at a depth of 20 to 40 inches.	Sandstone at a depth of 20 to 40 inches; medium to low shear strength; fair to good compaction.	Well drained	Sandstone at a depth of 20 to 40 inches; erodible; uneven slope; slope of as much as 20 percent.
Generally moderate: moderate shrink-swell potential. Severe where slope is more than 15 percent. Some lateral seepage.	Good where slope is 2 to 15 percent. Fair where slope is 15 to 25 percent. Poor where slope is more than 25 percent.	Fair: 12 inches of suitable material. Poor where slope is more than 15 percent.	Moderate permeability; sandstone at a depth of 20 to 40 inches.	Sandstone at a depth of 20 to 40 inches; medium to low shear strength; fair to good compaction.	Well drained	Sandstone at a depth of 20 to 40 inches; erodible; uneven slope.
Severe: high shrink-swell potential; plastic clay.	Poor: high shrink-swell potential; plastic clay.	Fair: 10 inches of suitable material.	Slow permeability below a depth of 2 feet; seasonal perched water table.	Medium to low shear strength; medium to high compressibility; low permeability if compacted.	Very slow permeability; claypan; seasonal perched water table.	Very slow permeability; claypan; difficult to vegetate.
Severe: sandstone at a depth of 10 to 20 inches.	Good where slope is 0 to 15 percent. Fair where slope is more than 15 percent.	Generally fair: coarse fragments. Poor where slope is more than 15 percent.	Sandstone at a depth of 10 to 20 inches; slope of as much as 25 percent.	Sandstone at a depth of 10 to 20 inches; medium shear strength; fair to good compaction.	Well drained	Sandstone at a depth of 10 to 20 inches; slope of as much as 25 percent.
Moderate: moderate shrink-swell potential.	Fair: moderate shrink-swell potential.	Fair: 12 inches of suitable material.	Slow permeability below a depth of 3 feet; seasonal perched water table; slope of as much as 10 percent.	Medium to low shear strength; medium to high compressibility; low permeability if compacted.	Slow permeability; fragipan; seasonal perched water table; slope of as much as 10 percent.	Slow permeability; fragipan; irregular slope.
Moderate: moderate shrink-swell potential.	Fair: moderate shrink-swell potential.	Fair: 12 inches of suitable material.	Moderate permeability; slope of as much as 15 percent.	Medium to low shear strength; low permeability if compacted; medium compressibility.	Well drained	Erodible: slope of as much as 15 percent.
Moderate: moderate shrink-swell potential.	Fair: moderate shrink-swell potential.	Good for silt loam. Fair for silty clay loam.	Moderate permeability; seasonal water table; slope of as much as 10 percent.	Medium to low shear strength; low permeability if compacted; medium compressibility.	Moderately well drained.	All features favorable.
Generally moderate: moderate shrink-swell potential. Severe where slope is more than 15 percent.	Fair: moderate shrink-swell potential.	Fair: coarse fragments. Poor where slope is more than 15 percent.	Moderate permeability; slope of as much as 20 percent.	Medium to low shear strength; low permeability if compacted.	Well drained	Coarse fragments; uneven slope; slope of as much as 20 percent.

TABLE 7.—*Interpretations*

Soil series and map symbols	Degree and kind of limitation for—				
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings without basements	Sanitary landfill
Gasconade. Mapped only in a complex with Rock land.	Severe: limestone at a depth of 10 to 20 inches; slope.	Severe: limestone at a depth of 10 to 20 inches; slope.	Severe: limestone at a depth of 10 to 20 inches; slope.	Severe: limestone at a depth of 10 to 20 inches.	Severe: limestone at a depth of 10 to 20 inches.
Goss: GoC, GoD	Moderate where slope is 2 to 15 percent; moderate permeability. Severe where slope is 15 to 50 percent.	Moderate where slope is 2 to 15 percent; moderate permeability; cherty clay material. Severe where slope is 15 to 50 percent.	Moderate: cherty clay material.	Generally moderate: moderate shrink-swell potential; plastic. Severe where slope is more than 15 percent.	Generally moderate: cherty clay. Severe where slope is more than 25 percent.
Hartwell: HtA, HtB, HtB2, HyB3	Severe: slow permeability; seasonal perched water table.	Moderate: moderate permeability at floor of lagoon.[1]	Severe: somewhat poorly drained; seasonal perched water table; clay.	Severe: seasonal perched water table; high shrink-swell potential; plastic CL material.	Moderate: somewhat poorly drained; silty clay loam.
Lightning: Ls	Severe: very slow permeability; seasonal water table; subject to flooding.	Slight where protected from flooding. Severe where not protected.[1]	Severe: poorly drained; seasonal water table; subject to flooding; silty clay.	Severe: poorly drained; seasonal water table; subject to flooding.	Severe: poorly drained; subject to flooding.
Mandeville: MaB, MaC2, MaD	Severe: shale at a depth of 20 to 40 inches.	Severe: shale at a depth of 20 to 40 inches.	Generally moderate: shale at a depth to 40 inches is rippable. Severe where slope is more than 10 percent.	Slight where slope is 0 to 10 percent; shale at a depth of 20 to 40 inches is rippable. Moderate to severe where slope is more than 10 percent.	Moderate: shale at a depth of 20 to 40 inches is rippable; moderate permeability.
Mine pits and dumps: Mp. Too variable to be rated.					
Muldrow: Mu	Severe: very slow permeability; seasonal water table; subject to flooding.	Slight where protected from flooding. Severe where not protected.[1]	Severe: somewhat poorly drained; seasonal water table; subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.
Newtonia: NeB	Slight	Moderate: moderate permeability.	Moderate: silty clay and clay is easily dug.	Moderate: moderate shrink-swell potential.	Moderate: silty clay loam; moderate permeability.
Norris: NoD2	Severe: shale at a depth of 10 to 20 inches; slope.	Severe: shale at a depth of 10 to 20 inches; slope.	Severe: shale at a depth of 10 to 20 inches; slope.	Severe: shale at a depth of 10 to 20 inches; slope.	Moderate: less than 60 inches of rippable rock; slope.

See footnote at end of table.

of engineering properties—Continued

Degree and kind of limitation for—Continued	Suitability as source of—		Soil features affecting—			
Local roads and streets	Road fill	Topsoil	Pond reservoir areas	Embankments, dikes, and levees	Drainage for crops and pasture	Terraces and diversions
Severe: limestone at a depth of 10 to 20 inches.	Generally fair: moderate shrink-swell potential. Poor where slope is more than 25 percent.	Poor: less than 8 inches thick; more than 15 percent coarse fragments.	Limestone at a depth of 10 to 20 inches.	Limestone at a depth of 10 to 20 inches; medium shear strength.	Somewhat excessively drained.	Limestone at a depth of 10 to 20 inches; slope of as much as 15 percent.
Generally moderate: moderate shrink-swell potential. Severe where slope is more than 15 percent.	Generally fair: moderate shrink-swell potential. Poor where slope is more than 25 percent.	Poor: more than 15 percent coarse fragments.	Moderate permeability; slope of as much as 50 percent.	Medium to low shear strength; low permeability if compacted.	Well drained-----	Coarse fragments; uneven slope; slope of as much as 50 percent.
Severe: high shrink-swell potential; plastic clay.	Poor: high shrink-swell potential; plastic clay.	Fair: 15 inches of suitable material.	Slow permeability below a depth of 3 feet; seasonal perched water table.	Medium to low shear strength; medium to high compressibility; low permeability if compacted.	Slow permeability; claypan; seasonal perched water table.	Slow permeability; claypan; difficult to vegetate.
Severe: poorly drained; subject to flooding.	Poor: poorly drained; high shrink-swell potential.	Poor: poorly drained.	Very slow to slow permeability; seasonal water table; subject to flooding.	Medium to low shear strength; medium to high compressibility; low permeability if compacted.	Very slow permeability; seasonal water table; subject to flooding.	Practice not needed.
Generally moderate: clay loam. Severe where slope is more than 15 percent.	Good where slope is 2 to 15 percent. Fair where slope is more than 15 percent.	Good where slope is 2 to 10 percent. Fair where slope is more than 10 percent.	Moderate permeability; shale at a depth of 20 to 40 inches; slope of as much as 25 percent.	Shale at a depth of 20 to 40 inches; medium to low shear strength; low permeability if compacted.	Well drained-----	Shale at a depth of 20 to 40 inches; slope of as much as 25 percent; erodible.
Severe: subject to flooding.	Fair: somewhat poorly drained; moderate shrink-swell potential.	Fair: 14 inches of suitable material.	Very slow permeability; seasonal water table; subject to flooding.	Medium to low shear strength; medium to high compressibility; low permeability if compacted.	Very slow permeability; seasonal water table; subject to flooding.	Practice not needed.
Moderate: moderate shrink-swell potential.	Fair: moderate shrink-swell potential.	Fair: 14 inches of suitable material.	Moderate permeability.	Medium to low shear strength; medium to high compressibility; low permeability if compacted.	Well drained-----	All features favorable.
Severe: shale at a depth of 10 to 20 inches; slope.	Fair: slope-----	Fair: coarse fragments. Poor where slope is more than 15 percent.	Shale at a depth of 10 to 20 inches; slope of as much as 25 percent.	Shale at a depth of 10 to 20 inches; medium to low shear strength; medium compressibility.	Well drained-----	Shale at a depth of 10 to 20 inches; erodible; slope of as much as 25 percent.

TABLE 7.—*Interpretations*

Soil series and map symbols	Degree and kind of limitation for—				
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings without basements	Sanitary landfill
Osage: Os, Ot, Oy	Severe: very slow permeability; seasonal water table; subject to flooding.	Slight where protected from flooding. Severe where not protected.[1]	Severe: poorly drained; seasonal water table; subject to flooding; silty clay.	Severe: poorly drained; seasonal water table; subject to flooding; high shrink-swell potential.	Severe: poorly drained; subject to flooding; silty clay.
Quarles: Qu	Severe: slow permeability; seasonal water table.	Slight where protected from flooding. Severe where not protected.[1]	Severe: poorly drained; seasonal water table; silty clay.	Severe: poorly drained; seasonal water table; subject to flooding; high shrink-swell potential.	Severe: poorly drained; subject to flooding.
*Rock land: RgD. Too variable to be rated. For Gasconade part of RgD, see Gasconade series.					
Roseland: RoC, RoD, RsD3	Moderate: moderate permeability; shale at a depth of 30 to 60 inches.	Moderate: moderate permeability; shale at a depth of 30 to 60 inches.	Moderate: shale at a depth of 30 to 60 inches.	Moderate: moderate shrink-swell potential.	Moderate: 30 to 60 inches deep to bedrock; silty clay loam.
Snead: SnB, SnB2, SnC2	Severe: slow permeability; weathered shale at a depth of 20 to 40 inches; seasonal water table.	Moderate where slope is 2 to 5 percent; silty clay shale at floor of lagoon. Severe where slope is 5 to 15 percent.	Severe: seasonal water table; silty clay.	Severe: high shrink-swell potential; CH, MH material.	Severe: silty clay.
Summit: SuB, SuB2, SuC, SuC2	Severe: slow permeability; seasonal water table.	Moderate: slope [1]	Severe: somewhat poorly drained; seasonal water table; silty clay.	Severe: high shrink-swell potential; seasonal water table.	Severe: silty clay and clay.
Urich: Ur	Severe: slow permeability; seasonal water table; subject to flooding.	Slight where protected from flooding; Severe where not protected.[1]	Severe: poorly drained; seasonal water table; subject to flooding.	Severe: subject to flooding; high shrink-swell potential; poorly drained; seasonal water table; CH material.	Severe: poorly drained; subject to flooding.
Verdigris: Ve	Severe: seasonal water table; subject to flooding.	Moderate where protected from flooding: moderate permeability. Severe where not protected.[1]	Severe: seasonal water table; subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.

[1] Soil has seasonal perched water table or seasonal water table, but the floor of the lagoon is nearly impermeable material.

of engineering properties—Continued

Degree and kind of limitation for—Continued	Suitability as source of—		Soil features affecting—			
Local roads and streets	Road fill	Topsoil	Pond reservoir areas	Embankments, dikes, and levees	Drainage for crops and pasture	Terraces and diversions
Severe: poorly drained; subject to flooding.	Poor: poorly drained; high shrink-swell potential.	Poor: poorly drained.	Very slow permeability; seasonal water table; subject to flooding.	Medium to low shear strength; medium to high compressibility; low permeability if compacted.	Very slow permeability; seasonal water table; subject to flooding.	Practice not needed.
Severe: poorly drained; subject to flooding.	Poor: poorly drained; high shrink-swell potential.	Poor: poorly drained.	Slow permeability; seasonal water table; subject to flooding.	Medium to low shear strength; medium to high compressibility; low permeability if compacted.	Slow permeability; seasonal water table; subject to flooding.	Practice not needed.
Moderate: moderate shrink-swell potential.	Fair: moderate shrink-swell potential.	Fair: 12 inches of suitable material.	Slope of as much as 15 percent; shale at a depth of 30 to 60 inches.	Shale at a depth of 30 to 60 inches; medium compressibility.	Well drained	Shale at a depth of 30 to 60 inches; uneven slope; erodible.
Severe: high shrink-well potential; plastic clay.	Poor: high shrink-swell potential; plastic clay.	Poor: very firm clayey material.	Slow permeability; seasonal water table; shale at a depth of 20 to 40 inches; slope of as much as 15 percent.	Low to medium shear strength; high compressibility; fair to poor compaction.	Moderately well drained; slow permeability; seasonal water table; shale at a depth of 20 to 40 inches.	Shale at a depth of 20 to 40 inches; slow permeability; slope of as much as 15 percent; erodible.
Severe: high shrink-swell potential; plastic clay.	Poor: high shrink-swell potential; plastic clay.	Poor: less than 8 inches thick.	Slow permeability; seasonal water table; slope of as much as 10 percent.	Medium to low shear strength; medium to high compressibility; low permeability if compacted.	Slow permeability; seasonal water table; slope of as much as 10 percent.	Slow permeability; erodible; seep areas.
Severe: poorly drained; subject to flooding.	Poor: poorly drained; high shrink-swell potential.	Poor: poorly drained.	Slow permeability; seasonal water table; subject to flooding.	Medium to low shear strength; high compressibility; low permeability if compacted.	Slow permeability; seasonal water table; subject to flooding.	Practice not needed.
Severe: subject to flooding.	Fair: CL material.	Good	Moderate permeability; seasonal water table; subject to flooding.	Medium to low shear strength; medium compressibility; fair to good compaction.	Moderately well drained; moderate permeability; seasonal water table; subject to flooding.	Practice not needed.

stallations of steel that intersect soil boundaries or soil horizons are more susceptible to corrosion than installations entirely in one kind of soil or in one soil horizon. Corrosivity for concrete is influenced mainly by the content of sodium or magnesium sulfate but also by soil texture and acidity. A corrosivity rating of *low* means that there is a low probability of soil-induced corrosion damage. A rating of *high* means that there is a high probability of damage, so that protective measures for steel and more resistant concrete should be used to reduce damage.

Engineering interpretations

The interpretations in table 7 are based on the engineering properties of soils shown in table 6, on test data for soils in this survey area and others nearby or adjoining, and on the experience of engineers and soil scientists with the soils of Henry County. In table 7, ratings are used to summarize limitations or suitability of the soils for all listed purposes other than for drainage for crops and pasture; pond reservoir areas; embankments, dikes, and levees; and terraces and diversions. For these particular uses, table 7 lists those soil features not be overlooked in planning, installation, and maintenance.

Soil limitations are indicated by the ratings *slight*, *moderate*, and *severe*. Slight means that soil properties are generally favorable for the rated use, or in other words, that limitations are minor and easily overcome. *Moderate* means that some soil properties are unfavorable but can be overcome or modified by special planning and design. *Severe* means that soil properties are so unfavorable and so difficult to correct or overcome as to require major soil reclamation, special design, or intensive maintenance. For some uses, the rating of severe is divided to obtain ratings of severe and very severe. *Very severe* means one or more soil properties are so infavorable for a particular use that overcoming the limitations is extremely difficult and costly and are commonly not practical for the rated use.

Soil suitability is rated by the terms good, fair, and poor, which have, respectively, meanings approximately parrallel to the terms slight, moderate, and severe.

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into natural soil. The soil material between depths of 18 inches and 6 feet is evaluated. The soil properties considered are those that affect both absorption of effluent and construction and operation of the system. Properties that affect absorption are permeability, depth of water table or rock, and susceptibility to flooding. Soil properties that affect difficulty of layout and construction include slope and also the risk of soil erosion, lateral seepage, and downslope flow of effluent. Large rocks or boulders increase construction costs.

Sewage lagoons are shallow ponds constructed to hold sewage within a depth of 2 to 5 feet long enough for bacteria to decompose the solids. A lagoon has a nearly level floor and sides, or embankments, of compacted soil material. The assumption is made that the embankment is compacted to medium density and the pond is protected from flooding. Properties are considered that affect the pond floor and the embankment. Those that affect the pond floor are permeability, organic-matter content, and slope; if the floor needs to be leveled, depth to bedrock also becomes important. The soil properties that affect the embankment are the engineering properties of the embankment material as interpreted from the Unified soil classification and the amount of stones, if any, that influence the ease of excavation and compaction of the embankment material.

Shallow excavations are those that require digging or trenching to a depth of less than 6 feet, as for example, excavations for pipelines, sewerlines, phone and power transmission lines, basements, open ditches, and cemeteries. Desirable soil properties are good workability, moderate resistance to sloughing, gentle slopes, absence of rock outcrops or big stones, and freedom from flooding or a high water table.

Dwellings without basements, as rated in table 7, are not more than three stories high and are supported by foundation footings placed in undisturbed soil. The features that affect the rating of a soil for dwellings are those that relate to capacity to support load and resist settlement under load, and those that relate to ease of excavation. Soil properties that affect capacity to support load are wetness, susceptibility to flooding, density, plasticity, texture, and shrink-swell potential. Those that affect excavation are wetness, slope, depth to bedrock, and content of stones and rocks.

Sanitary landfill is a method of disposing of refuse in dug trenches. The waste is spread in thin layers, compacted, and covered with soil throughout the disposal period. Landfill areas are subject to heavy vehicular traffic. Some soil properties that affect suitability for landfill are ease of excavation, hazard of polluting ground water, and trafficability. The best soils have moderately slow permeability, withstand heavy traffic, and are friable and easy to excavate. Unless otherwise stated, the ratings in table 7 apply only to a depth of about 6 feet, and therefore limitation ratings of *slight* or *moderate* may not be valid if trenches are to be much deeper than that. For some soils, reliable predictions can be made to a depth of 10 or 15 feet, but regardless of that, every site should be investigated before it is selected.

Local roads and streets, as rated in table 7, have an all-weather surface expected to carry automobile traffic all year. They have a subgrade of underlying soil material; a base consisting of gravel, crushed rock, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. These roads are graded to shed water and have ordinary provisions for drainage. They are built mainly from soil at hand, and most cuts and fills are less than 6 feet deep.

Soil properties that most affect design and construction of local roads and streets are load-supporting capacity and stability of the subgrade, and the workability and quantity of cut and fill material available. The AASHO and Unified classifications of the soil material, and also the shrink-swell potential, indicate traf-

fic-supporting capacity. Wetness and flooding affect stability of the material. Slope, depth to hard rock, content of stones and rocks, and wetness affect ease of excavation and amount of cut and fill needed to reach an even grade.

Road fill is soil material used in embankments for roads. The suitability ratings reflect (1) the predicted performance of soil after it has been placed in an embankment that has been properly compacted and provided with adequate drainage and (2) the relative ease of excavating the material at borrow areas.

Topsoil is used for topdressing an area where vegetation is to be established and maintained. Suitability is affected mainly be ease of working and spreading the soil material, as for preparing a seedbed; natural fertility of the material, or the response of plants where fertilizer is applied; and absence of substances toxic to plants. Texture of the soil material and its content of stone fragments are characteristics that affect suitability, but also considered in the ratings is damage that will result at the area from which topsoil is taken.

Sand and gravel deposits suitable as a source of supply are very limited in Henry County and exist only in small local areas. Sand and gravel ratings are not presented in table 7.

Pond reservoir areas hold water behind a dam or embankment. Soils suitable for pond reservoir areas have low seepage, which is related to their permeability and depth to fractured or permeable bedrock or other permeable material.

Embankments, dikes, and levees require soil material resistant to seepage and piping and of favorable stability, shrink-swell potential, shear strength, and compactibility. Presence of stones or organic material in a soil are among the factors that are unfavorable.

Drainage for crops and pasture is affected by such soil properties as permeability, texture, and structure; depth to claypan, rock, or other layers that influence rate of water movement; depth to the water table; slope; stability of ditchbanks; susceptibility to stream overflow; salinity or alkalinity; and availability of outlets for drainage.

Terraces and diversions are embankments, or ridges, constructed across the slope to intercept runoff so that it soaks into the soil or flows slowly to a prepared outlet. Features that affect suitability of a soil for terraces are uniformity and steepness of slope; depth to bedrock or other unfavorable material; presence of stones; permeability; and resistance to water erosion, soil slipping, and soil blowing. A soil suitable for these structures provides outlets for runoff and is not difficult to vegetate.

Soil features affecting irrigation are not presented in table 7. Irrigation is not a common practice in the county; however, a few small areas are irrigated.

Formation and Classification of the Soils

This section describes how the five factors of soil formation have affected the development of soils in Henry County. It also explains the current system of soil classification and places each soil series in the classes of that system.

Factors of Soil Formation

Soil is produced by the action of soil-forming processes on materials deposited or accumulated by geologic forces. The characteristics of the soil are determined by (1) physical and mineralogical composition of the parent material, (2) climate under which the soil material has accumulated and existed since accumulation, (3) plant and animal life on and in the soil, (4) relief, or lay of the land, and (5) length of time the forces of soil formation have acted on the soil material.

Climate and plant and animal life, chiefly plants, are active factors of soil formation. They act on the parent material that has accumulated through the weathering of rocks and slowly change it to a natural body that has genetically related horizons. The effects of climate and plant and animal life are conditioned by relief. The parent material also affects the kind of soil profile that is formed and, in extreme cases, determines it almost entirely. Finally, time is needed to change the parent material into a soil. It may be of long or short duration, but some time is always required for the formation of distinct horizons.

The factors of soil formation are so closely interrelated in their effect on the soil that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four. Many of the processes of soil development are unknown.

Parent material

In Henry County differences in parent material have caused important differences among the soils. Parent material as defined by Jenny (*4*) is "the initial state of the soil system." It consists of (1) material weathered in place from rock; (2) loess, or material transported by wind; and (3) alluvium and colluvium, or material transported by water and gravity. The material weathered in place from rock is directly related to the underlying rock. Materials moved by wind, water, or gravity and laid down as unconsolidated deposits of sand, silt, clay, and fragments of rock commonly are related to the transported soils or rocks from which they formed.

The soils in Henry County formed mainly in material weathered in place from bedrock. The A, B, and C horizons of a soil may form in more than one parent material rather than all in the same parent material. In some places, especially on the high, wide divides and adjacent to gentle slopes, loess thinly mantles the weathered bedrock. This wind-deposited material has developed into the surface layer and upper part of the subsoil in these places, but in very few places has it had a singificant influence on the lower part of the subsoil. In no place did the entire soil form in loess. In the stream valleys, sediment was washed from the nearby uplands and deposited by streams. These al-

luvial deposits are made up of materials from both the loessal covering and from residuum.

The oldest bedrock formations of Henry County are in the southeast corner. The youngest formations are in the northwest corner. In ascending order, they are the Osagian of the Mississippian System and the Cherokee and Marmaton Groups of the Pennsylvanian System (*7*).

The bedrock of the Mississippian System is largely limestone. Soils of the Creldon, Crider, Eldon, Goss, and Gasconade series are underlain by rocks of the Mississippian System.

The Cherokee Group is dominated by acid micaceous shales and coal. It has minor to moderate amounts of sandstone and limestone. The Hartwell and Deepwater series formed over such beds of the Cherokee Group. They are underlain by acid micaceous shales. The Barco, Bolivar, and Coweta soils formed in residuum derived from sandstone.

The Marmaton Group is mostly limestone beds and dark-colored phosphatic shales and some coal. Soils of the Newtonia, Snead, and Summit series are underlain by rocks of the Marmaton Group.

Osage, Urich, and Verdigris soils formed in alluvial deposits.

Climate

Climate largely determines the rate of weathering of soils, and it also influences the type of vegetation that grows on soils. Henry County has temperate, humid, continental climate. The average annual precipitation is about 40 inches (*3*), and the frost-free growing season averages 166 days (*2*). The prevailing winds are from the south or southwest. These winds are generally warm and moist, but in most years between mid-July and September, they are hot and dry and rainfall is limited. Short periods of excessive rainfall in spring or fall, or both, are common. The soils are frozen for short periods in winter, and the soil formation processes are slowed. In most places the average annual temperature of the soil at a depth of 20 inches is about 59° F.

The humid, temperate climate of Henry County is conducive to the relatively rapid breakdown of minerals for the formation of clay and to the translocation of these materials downward in the soil profile. The subsoil of the Cherokee and Hartwell soils is high in clay content. These soils therefore have very slow to slow permeability in the subsoil, which causes excess wetness in the seasons of highest rainfall. Conversely, the low available water holding capacity of their subsoil causes droughtiness in the hot summer months when rainfall is low.

Plant and animal life

Plants and animals that live in the soil range in size from tiny bacteria to large rodents. These plants, micro-organisms, and animals, together with man, have all affected soil formation in Henry County.

The decomposition or partial decomposition of plant and animal tissue leaves residue, which results in the accumulation of organic matter in soils. The part that is dark brown in color, colloidal in nature, and resistant to further decomposition is called humus. The presence of humus increases soil granulation and improves tilth. The color of the soil profile, the nitrogen supply, and the natural fertility are directly related to the amount and kind of organic matter in the soil.

The rooting habits, mineral composition, and cycle of residue return to the soil differ for grass vegetation and tree vegetation. There also is a marked difference in the micro-organisms and animals associated with each kind of vegetation. Other factors being equal, a soil that formed under grass is quite different from one that formed under trees. The native vegetation of Henry County was largely prairie grasses, but deciduous trees grew along most of the streams. These trees were the dominant vegetation in the extreme southeastern part of the county.

The organic matter that accumulates under trees is mixed with the upper part of the surface layer generally to a depth of less than 6 inches, but in many places to a depth of less than 4 inches. A leached, light-colored, brown, yellowish-brown, or grayish-brown subsurface layer that has platy structure is formed. Beneath this layer a brighter colored, finer textured layer that has blocky structure is formed. The nitrogen content, fertility level, and organic matter content are relatively lower in these soils than in soils that formed under grass. Under grass the rate of mixture of organic matter is higher and the total amount is greater than it is under trees. Micro-organisms are generally more numerous in the upper layers, where the grass roots are concentrated. As a result the organic stains or films are more numerous and generally are thicker on the blocky structural aggregates that form the subsoil. The nitrogen supply, organic-matter content, and natural fertility normally are higher in soils that formed under trees than in those that formed under grass. In Henry County the light-colored soils that formed under trees include the Goss, Bolivar, Crider, Mandeville, and Roseland soils. The dark-colored soils that formed under prairie grasses include the Barco, Creldon, Deepwater, Eldon, Hartwell, Snead, and Summit soils.

Micro-organisms reduce organic matter to humus. The release of plant nutrients and the fixation of atmospheric nitrogen by nodule bacteria are examples of the contributions of micro-organisms to soil formation and plant growth. Earthworms, insects, and burrowing animals also have a favorable effect on soil tilth, fertility, and drainage.

Man also has had an influence on soil formation. Soil in many places has been tilled and used for intensive cropping. Grain and forage residue has been removed from the soil and used as feed and forage. Chemical sprays are often used to reduce the growth of some residue-producing plants and also to help control insects and pests. These practices tend to leave the soil surface bare of protective cover and permit erosion of the surface layer. A significant acreage of the soils in Henry County has been strip mined.

Relief

Henry County includes three distinct regions of local relief. These regions are a result of erosion by

South Grand River and its tributaries. The erosion has been controlled to a marked degree by the geologic structure and the relative resistance of the bedrock to weathering and erosion.

The central region, generally including the southwestern and central parts of the county from Montrose to Clinton, has been lowered considerably. Elevation ranges from about 705 to 780 feet above sea level. Slopes are gentle, and geologic materials are predominantly acid shale and sandstone. The major soils in this area are Hartwell, Deepwater, and Barco soils. Hartwell soils have subnormal relief, formed in material from acid shale, and are nearly level and gently sloping. Deepwater and Barco soils have somewhat shorter, more rolling slopes and normal relief. They formed in materials from acid shale and sandstone.

A second region occurs generally in the northern and western parts of the county. The boundary coincides generally with the outcrops of the Lagonda Formation of Pennsylvanian age. The area is higher in elevation than the central region, ranging from 750 to 950 feet above sea level. It includes the rolling to hilly relief between the major creeks of the general area. Slopes are steeper than in the central region, and geologic materials are primarily limestone and shale. The limestone materials are less resistant to weathering than the shales. The main soils in this area are Summit, Snead, and Newtonia soils.

The third region is in the eastern and southern parts of the county where the drainage system cuts through sandstone materials of the Lower Pennsylvanian System and cherty limestone of the Mississippian System. The main soils of this region are Goss, Crider, Creldon, and Eldon soils, which have normal to excessive relief. Elevation ranges from 683 to 934 feet above sea level, and marked changes occur within relatively short distances.

Stream drainage of the county is provided mainly by the South Grand River and a major tributary, Big Creek, which enter the county in the northwestern part of the county. The South Grand River flows diagonally southeast and leaves the county in the extreme southeast. Steep slopes and soil-rock complexes occur intermittently along most of the major streams in the northern, eastern, and southern parts of the county. Elevation above sea level ranges from 950 feet in the high divides along the northern boundary of the county to about 680 feet where the Osage River marks the county boundary in its extreme southeast corner.

Time

In addition to the factors of parent material, climate, plant and animal life, and relief, time has played an important role in soil development in Henry County. It should be noted that some time is always required to convert parent material to soil. A long time is required to produce a mature soil, and a relatively short time is required for a youthful soil to acquire distinct characteristics.

The youngest soils in the country are best exemplified by the Verdigris soils. The material in which these soils formed washed from nearby uplands and was deposited by the local streams. In extreme cases of erosion and deposition, it is conceivable that 30 to 40 inches or more of this material could be deposited in as little as 1 year. Horizons within the soils are not distinct or easily discernible. The upper 7 inches of the Verdigris soils in the survey area is only slightly different from the rest of the profile. The main difference is the lack of discernible depositional strata in the upper layer; also, a weak, fine, granular structure has developed. These differences very likely are a result of tillage and the incorporation of residue in the upper 7 inches in relatively recent years.

Old or mature soils of the county are best exemplified by Hartwell and Cherokee soils. These soils have a well-developed subsoil that is high in clay content and is strikingly different than the adjacent upper or lower layers. They developed in areas of subnormal relief. Runoff was slow to medium, and the soils remained wet during much of the year. Erosion under the native prairie grasses was negligible. Water, which did not evaporate or run off, moved downward through the soils. The subnormal relief and excess water hastened the process of soil formation, and in time the clay particles moved from the surface layer down into the lower layers. This translocation of clay resulted in the accumulation of dark clay immediately below a bleached, severely leached, silty subsurface layer. Relief, and its influence on local climate, was a very significant factor in the formation and development of these soils. The length of time required for the development of mature soils was considerably shortened.

Other soils in the county, such as the Coweta, Norris, and Roseland soils, have been in place as long as Hartwell and Cherokee soils and have had equal time for development. However, these soils have thin or weak horizon development and are considered to be youthful or immature soils. Differences in parent materials, animal life, and relief have apparently been the dominant factors in development. A much longer time will be required for these soils to develop to maturity under these conditions.

Other soils of the county range in profile development from fairly youthful to fairly old. The older profiles are exemplified by the Creldon soils, in which a fragipan has developed. A fairly youthful profile is represented by the Mandeville soils, which have a relatively thin, medium-textured subsoil. In each case the particular stage of profile development is an expression of the interrelationship of the various factors of soil formation.

Classification of Soils

Soils are classified so that we can more easily remember their signifiicant characteristics. Classification enables us to assemble knowledge about the soils, to see their relationship to one another and to their environment, and to develop principles that help us to understand their behavior and their response to manipulation. First through classification, and then through the use of soil maps, we can apply our knowledge of soils to specific fields and other tracts of land.

The narrow categories of classification, such as those used in detailed soil surveys, allow us to organize and apply knowledge about soils in managing farms, fields, and woodlands, in developing rural areas; in engineering work; and in many other ways. Soils are placed in broad classes to facilitate study and comparison in large areas such as countries and continents.

The system of soil classification used was adopted by the National Cooperative Soil Survey in 1965. Because this system is under continual study, readers interested in new developments should search the latest literature available (*8, 10*).

The system of classification has six categories. Beginning with the broadest, these categories are order, suborder, great group, subgroup, family, and series. In this system the criteria used as a basis for classification are soil properties that are observable and measurable. The properties are chosen, however, so that the soils of similar genesis, or mode or origin, are grouped. The same property or subdivisions of this property may be used in several different categories. In table 8 the soil series of Henry County are placed in four categories of the system. The classes of the system are briefly defined in the following paragraphs.

ORDER: Ten soil orders are recognized. The properties used to differentiate among soil orders are those that tend to give broad climatic groupings of soils. Three exceptions to this are the Entisols, Histosols, and Vertisols, which occur in many different climates. Each order is named with a word or three or four syllables ending in *sol* (Moll-i-sol).

SUBORDER: Each order is subdivided into suborders using those soil characteristics that seem to produce classes with the greatest genetic similarity. The suborders are more narrowly defined than are the orders. The soil properties used to separate suborders are mainly those that reflect either the presence or absence of a water table at a shallow depth, soil climate, the accumulation of clay, iron, or organic carbon in the upper layers of soils, cracking of soils caused by a decrease in soil moisture, and fine stratification. The names of suborders have two syllables. The last syllable indicates the order. An example is Aquoll (*Aqu*, meaning water or wet, and *oll*, from Mollisol).

GREAT GROUP: Soil suborders are separated into great groups on the basis of uniformity in the kinds and sequence of soil horizons and features. The horizons used to make separations are those in which clay, carbonates, and other constituents have accumulated or have been removed and those that have pans that interfere with growth of roots, movement of water, or both. Some features used are soil acidity, soil climate, soil composition, and soil color. The names of great groups have three or four syllables and are made by adding a prefix to the name of the suborder. An example is Argiaquoll (*Arg* meaning clay accumulation, *aqu* for wetness or water, and *oll* from Mollisols).

SUBGROUP: Great groups are subdivided into subgroups, one representing the central (typic) segment of the group, and others, called intergrades, that have properties of the group and also one or more properties of another great group, suborder, or order. Other subgroups may have soil properties unlike those of any other great group, suborder, or order. The names of subgroups are derived by placing one or more adjectives before the name of the great group. An example is Typic Argiaquolls (a typical Argiaquoll).

TABLE 8.—*Classification of soil series*

Series	Family	Subgroup	Order
Barco	Fine-loamy, mixed, thermic	Mollic Hapludalfs	Alfisols.
Bolivar	Fine-loamy, mixed, thermic	Ultic Hapludalfs	Alfisols.
Cherokee	Fine, mixed thermic	Typic Albaqualfs	Alfisols.
Coweta	Loamy, siliceous, thermic, shallow	Typic Hapludolls	Mollisols.
Creldon [1]	Fine, mixed, mesic	Mollic Fragiudalfs	Alfisols.
Crider [2]	Fine-silty, mixed, mesic	Typic Paleudalfs	Alfisols.
Deepwater	Fine-silty, mixed, thermic	Typic Argiudolls	Mollisols.
Eldon	Clayey-skeletal, mixed, mesic	Mollic Paleudalfs	Alfisols.
Gasconade	Clayey-skeletal, mixed, mesic	Lithic Hapludolls	Mollisols.
Goss	Clayey-skeletal, mixed, mesic	Typic Paleudalfs	Alfisols.
Hartwell	Fine, mixed, thermic	Typic Argialbolls	Mollisols.
Lightning	Fine, mixed, thermic	Typic Ochraqualfs	Alfisols.
Mandeville	Fine-loamy, mixed, mesic	Typic Hapludalfs	Alfisols.
Muldrow	Fine, mixed, thermic	Typic Argiaquolls	Mollisols.
Newtonia [3]	Fine-silty, mixed, thermic	Typic Paleudolls	Mollisols.
Norris	Loamy, mixed, acid, mesic, shallow	Typic Udorthents	Entisols.
Osage	Fine, montmorillonitic, thermic	Vertic Haplaquolls	Mollisols.
Quarles	Fine, mixed, thermic	Mollic Ochraqualfs	Alfisols.
Roseland	Loamy-skeletal, mixed, thermic	Umbric Dystrochrepts	Inceptisols.
Snead [4]	Fine, mixed, mesic	Aquic Hapludolls	Mollisols.
Summit	Fine, montmorillonitic, thermic	Vertic Argiudolls	Mollisols.
Urich	Fine-silty, mixed, thermic	Typic Argiaquolls	Mollisols.
Verdigris	Fine-silty, mixed, thermic	Cumulic Hapludolls	Mollisols.

[1] This soil is a taxadjunct to the series because it has a dominant color of grayish brown in the B22t horizon above the fragipan.

[2] This soil is a taxadjunct to the series because it has a base saturation in excess of 60 percent at a depth of 60 inches and lacks clay texture in the lower part of the B horizon.

[3] This soil is a taxadjunct to the series because it has a B21t horizon that has a finer texture and yellower hue than is normal for the series.

[4] This soil is a taxadjunct to the series because it lacks free carbonates to a depth of more than 20 inches.

FAMILY: Soil families are separated within a subgroup primarily on the basis of properties important to the growth of plants or to the behavior of soils when used for engineering. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, soil depth, and consistence. A family name consists of a series of adjectives preceding the subgroup name. The adjectives are the class names for texture, mineralogy, and so on, that are used as family differentiae (see table 8). An example is the fine-silty, mixed, noncalcareous, thermic family of typic Argiaquolls.

The eastern part of Henry County is in the mesic soil temperature regime, and the western part is in the thermic. The spread of the soil temperature regime within the county was not considered large enough to affect the use and management of the soils. Therefore, some mesic soils are mapped in thermic temperature areas and some thermic soils are mapped in mesic temperature areas.

General Nature of the County

This section provides general information about Henry County. The history and development, relief and drainage, farming, land use, climate, and other subjects of general interest are discussed.

History and Development

Henry County was originally a part of Lillard County, which made up much of the west-central part of the State. Henry County was organized in 1834. The first settlers came to what is now Henry County is 1831. The prairie was first plowed in the spring of 1832 (*5*). The early settlers located in the tree-covered areas on uplands near the larger streams. In these areas game and water were plentiful. Timber was available for construction of buildings and fences and for fuel. Cattle and work animals grazed the nearby prairies.

Settlement progressed slowly at first. Boonville, on the Missouri River, was the supply center. Indian trouble and Civil War strife slowed settlement until about 1870. Afterwards, population and farming increased rapidly. Coal mining became an important industry and still contributes significantly to the economy of the county.

The county is quite accessible to travel. It is crossed from west to east by State Routes 7 and 52 and from north to south by State Route 13. The system of county roads is good. The county is also served by two railroads. The small airport in the county probably will be expanded.

The total population of Henry County in 1970 was 18,451, of which 10,238 was urban and 8,213 rural. Clinton, the county seat, had a population of 7,504.

Relief and Drainage

The drainage pattern in Henry County follows the general relief of the county. Streamflow is generally southeast from the higher relief in the northwestern part of the county to the lower relief in the southeastern part. The main river is South Grand River, which enters the county about 6 miles south of the northwest corner, flows generally southeasterly, and leaves the county about 6 miles north of the southeast corner. Big Creek and Honey Creek are the main tributaries, and they drain the northwestern part of the county. Tebo Creek and several tributary streams drain the northern and northeastern parts of the county. Tebo Creek leaves the county in the east-central part and joins the Osage River in the adjacent county. Deepwater Creek drains the southwestern part of the county It flows easterly and joins the South Grand River about two-thirds of the way across the county. The Osage River is the meandering boundary of the southeastern corner of the county, but it drains very little of Henry County.

The flood plains of Big Creek, South Grand River, and Deepwater Creek are 1 to 2 miles wide and are of low gradient. The flood plain of the South Grand River narrows to less than one-fourth mile just below the junction with Deepwater Creek. It maintains this narrow valley throughout the rest of the county. This abrupt narrowing causes the soils of the flood plain above the point of narrowing to be quite wet and poorly drained. These soils are mainly in the Osage, Lightning, and Muldrow series. The rest of the flood plain is somewhat narrower and has numerous meandering channels. The soils in these areas commonly are also poorly drained. Among the soils on the narrow flood plain along the lower river channel are areas of somewhat better drained soils. The Verdigris soils are the most common soils in these areas.

In the central and western parts of the county, there are extensive areas of nearly level soils. The local relief on many farms in these areas is less than 10 feet. The soils in such areas commonly are poorly drained. In areas of normal relief the soils are moderately well drained and well drained.

In the northern and eastern parts of the county, the areas of low relief on uplands are confined to the relatively narrow ridges. Relief ranges from normal to excessive on every farm, and local variations in relief from 10 to 30 feet or more. Moderately well drained and well drained soils are common in areas of normal and excessive relief. The soils in the areas of excessive relief generally have thin upper layers and rocky material in or near the surface layer.

Farming

Farming accounts for the production of more income than any other activity in Henry County. According to the Census of Agriculture, in 1964 there were 1,617 farms in the county, a reduction from 1,776 in 1959. Of the total acreage of cropland, 58,406 acres was in corn and sorghum; 40,000 acres was in soybeans and row crops other than corn and sorghum; 21,304 acres was in close-growing crops; 44,700 acres was in hay and pasture; and 47,331 acres was idle, open, or in conservation use (*6*).

Corn wheat, and soybeans are the major cash crops. Many farmers use their crops to feed cattle and hogs. Cash-grain farms are most common in areas of nearly

level and gently sloping soils near the crests of divides that separate the watersheds of the major streams. In the areas of the county where the soils are more rolling, farming is more diversified. Grain crops similar to those grown for cash are grown in these areas, but most of the acreage is used for grain, grasses, hay, and legumes.

Farming is becoming more intensified as farms tend to become larger and the number of farms decreases. Irrigation promises to become more common as water supplies are developed. Suitable varieties of crops are being grown, and practices to control drainage and erosion are being used more extensively. The control of drainage and flooding on bottom lands is badly needed to increase crop growth and bring marginal wet areas into productive use.

Land Use Trends

There will be a significant change in land use in the county as a result of the construction of a large floodwater retention reservoir at Kaysinger Bluff near the town of Warsaw. Inundated lands will be removed from cultivation, and because of the relatively short distance between the lake and metropolitan Kansas City, recreational use of the lands adjacent to the lake will probably be increased. The increase in the area used for recreation probably will be accompanied by an increase in area used for wildlife habitat. The potential of the soils for wildlife habitat is high because of the intermingling of areas of tree-covered land, brushland, cropped land, and wasteland on many farms.

More than 14,000 acres in the county are areas of strip mines. This acreage is increasing steadily. The largest areas are in the north-central part of the county, about 5 to 10 miles northwest of Clinton. Another large area is in the northeastern part of the county, where the Middle Fork of Tebo Creek enters the county. Some mined areas have been planted to trees, and some have undergone natural revegetation, but the general quality of the soils in these areas is low. Some smoothing of the areas and proper management could increase their productivity to a marked degree.

Climate [5]

The records used to compile the data in tables 9 and 10 are from the town of Clinton. The elevation at Clinton is about 740 feet above sea level.

Clinton is subject to relatively significant fluctuations in temperature and precipation. As little as 0.32 inch and as much as 4.96 inches of precipitation have fallen in January. June commonly is the month that has the largest amount of rain, and as little as 0.70 inch and as much as 18.63 inches have fallen in that month. January temperatures have been as high as 74° and as low as −22F°. July has had temperatures as high as 118° and as low as 46°.

[5] By JAMES D. MCQUIGG, climatologist for Missouri, National Weather Service, U.S. Department of Commerce.

TABLE 9.—*Temperature*

[Data from Clinton,

Month	Temperature							Average heating degree-days [1]
	Average daily maximum	Average daily minimum	Average	Extremes				
				Record highest	Year	Record lowest	Year	
	°F	°F	°F	°F		°F		
January	40.8	20.9	30.9	74	1947	−22	1959	1,062
February	45.4	24.5	34.9	78	1932	−21	1951	854
March	53.8	31.6	42.9	88	[2] 1946	−12	1960	695
April	67.3	43.8	55.6	92	1936	18	[2] 1954	318
May	76.3	58.6	65.2	105	1934	29	1960	113
June	86.1	63.2	74.7	111	1936	40	1956	13
July	92.3	67.1	79.7	118	1936	46	1959	0
August	91.5	66.0	78.8	116	1936	46	[2] 1958	1
September	83.0	56.6	70.0	107	1936	30	1942	51
October	71.9	45.9	59.0	94	[2] 1953	15	1952	227
November	55.7	32.4	44.1	85	1937	0	1937	637
December	44.7	25.2	35.0	77	1948	−11	1943	932
Year	67.4	44.7	55.9	118	1936	−22	1959	4,903

[1] Based on a temperature of 65° F and computed from average monthly temperatures. These data show relative heating requirements for dwellings. Degree-days for a single day are obtained by subtracting the average temperature of the day from 65°.

[2] Latest year of occurrence.

Thunderstorms have occurred in fall and winter, but they commonly are more numerous in May and June. In July and August the weather generally is drier. About 1 year in 10 the total amount of rain that falls in 1 hour exceeds 2.55 inches. About 1 year in 100 the total amount of rain that falls in 24 hours is 7.90 inches or more.

In about 1 year in 10, less than 6 inches of snow falls at Clinton, and in about 1 year in 10 the amount of snow exceeds 24 inches. The snow cover commonly does not remain long. Rarely is there a continuous snow cover for as long as 30 days.

The average annual total precipitation is close to 39 inches; however, it varies considerably. Much of this comes during the cropping season. Some precipitation enters the streams of Henry County, and some goes into the many farm ponds in the area. During the warm months in spring and summer and early in fall, a considerable amount of water evaporates from these ponds. The exact amount of this loss varies from pond to pond and from year to year, but it averages about 40 to 45 inches of water per year. About 30 inches of water, or roughly 75 percent of the total, evaporates from May through October.

An analysis of streamflow records on the South Grand River at Brownington shows that the average annual runoff in the Clinton area is nearly 8 inches of water. In about 1 year in 3 the runoff is less than 4 inches, in and about 1 year in 3 it is more than 12 inches.

The column "average heating degree-days" in table 9 provides a comparative number, or average, for calculating relative heating requirements for dwellings. Fuel consumption for heating is proportional to total degree-days; that is, a month that has twice as many degree-days as another month requires twice as much fuel for heating.

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and precipitation data

Missouri; 1931–1960]

Precipitation									Average number of days with—				
Rainfall			Snow and sleet						Maximum temperature of—		Minimum temperature of—		Precipitation of—
Average	Extremes		Average	Extremes									
	Maximum in 24 hours	Year		Maximum	Year	Maximum in 24 hours	Year		90° F or above	32° F or below	Between 0° and 32° F	0° F or below	0.10 inch or more
Inches	*Inches*		*Inches*	*Inches*		*Inches*							
1.65	1.59	1946	3.0	15.4	1940	14	1958		0	8	27	2	4
1.91	1.80	1931	3.0	19.0	1938	18	1938		0	5	23	1	4
2.55	1.75	1959	3.0	19.5	1960	8	1940		0	2	18	(3)	6
3.76	2.65	1944	.3	5.0	1945	4	1945		(3)	0	4	(3)	7
5.15	5.46	1943	0	(4)	------	------	------		2	0	(3)	0	8
5.53	7.00	1943	0	------	------	------	------		11	0	0	0	7
3.37	4.75	1956	0	------	------	------	------		20	0	0	0	5
3.82	4.80	1955	0	------	------	------	------		19	0	0	0	5
3.85	3.65	1953	0	------	------	------	------		9	0	0	0	5
3.35	4.12	1955	0	(4)	1957	(4)	1957		1	0	0	0	5
2.37	3.45	1958	1.4	10.0	[2] 1934	10	1934		0	1	16	(3)	4
1.86	2.75	1932	2.5	10.5	1943	9	1942		0	5	25	(3)	4
39.17	7.00	1943	13.2	19.5	1960	18	1938		62	21	116	3	64

[3] Less than one-half day.

[4] Trace; an amount too small to measure.

TABLE 10.—*Probability of last freezing temperature in spring and first in fall*

Probability	Dates for given probability and temperature				
	16° F or lower	20° F or lower	24° F or lower	28° F or lower	32° F or lower
Spring:					
1 year in 10 later than	March 21	March 27	April 7	April 15	April 24
2 years in 10 later than	March 16	March 22	April 2	April 10	April 19
5 years in 10 later than	February 28	March 9	March 23	April 1	April 11
Fall:					
1 year in 10 earlier than	November 20	November 8	October 31	October 20	October 9
2 years in 10 earlier than	November 25	November 13	November 5	October 25	October 14
5 years in 10 earlier than	December 5	November 23	November 15	November 4	October 24

7th approximation. 265 pp., illus. [Supplements issued in March 1967 and September 1968]

(11) ———. 1968. Soil survey interpretations for woodlands in the Boston mountains and Arkansas valleys and ridges of Arkansas and Oklahoma. Progress Rept. W-7, 20 pp.

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Glossary

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Available water capacity (also termed available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.

Base saturation. The degree to which material that has base-exchange properties is saturated with exchangeable cations other than hydrogen, expressed as a percentage of the cation-exchange capacity.

Calcareous soil. A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of clay on the surface of a soil aggregate. Synonyms: clay coat, clay skin.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrations of compounds, or of soil grains cemented together. The composition of some concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are examples of material commonly found in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a 'wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening.

Drainage class (natural). Refers to the conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural soil drainage are recognized.

Excessively drained soils are commonly very porous and rapidly permeable and have a low water-holding capacity.

Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.

Well-drained soils are nearly free from mottling and are commonly of intermediate texture.

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and mottling in the lower B and the C horizons.

Somewhat poorly drained soils are wet for significant periods but not all the time, and some soils commonly have mottling at a depth below 6 to 16 inches.

Poorly drained soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Fragipan. A loamy, brittle, subsurface horizon that is very low in organic-matter content and clay but is rich in silt or very fine sand. The layer is seemingly cemented. When dry, it is hard or very hard and has a high bulk density in comparison with the horizon or horizons above it. When moist, the fragipan tendes to rupture suddenly if pressure is applied, rather than to deform slowly. The layer is generally mottled, is slowly or very slowly permeable to water, and has few or many bleached fracture planes that form polygons. Fragipans are a few inches to several feet thick; they generally occur below the B horizon, 15 to 40 inches below the surface.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Loess. Fine-grained material, dominantly of silt-sized particles, that has been deposited by wind.

Mottling, soil. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent.* The size measurements are these: *fine,* less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium,* ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse,* more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Munsell notation. A system for designating color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with a hue of 10YR, a value of 6, and a chroma of 4.

Permeability. The quality that enables the soil to transmit water or air. Terms used to describe permeability are as follows: *very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

pH value. A numerical means for designating acidity and alkalinity in soils. A pH value of 7.0 indicates precise neutrality; a higher value, alkalinity; and a lower value, acidity.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	Neutral	6.6 to 7.3
Very strongly acid	4.5 to 5.0	Mildly alkaline	7.4 to 7.8
Strongly acid	5.1 to 5.5	Moderately alkaline	7.9 to 8.4
Medium acid	5.6 to 6.0	Strongly alkaline	8.5 to 9.0
Slightly acid	6.1 to 6.5	Very strongly alkaline	9.1 and higher

Residuum. Unconsolidated, partly weathered mineral material that accumulates over disintegrating solid rock. Residuum is not soil but is frequently the material in which a soil has formed.

Sand. Individual rock or mineral fragments in a soil that range in diameter from 0.05 to 2.0 millimeters. Most sand grains consists of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Soil. A natural, three-dimensional body on the earth's surface that supports plants and that has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Structure, soil. The arranagement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular. Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it may soak into the soil or flow slowly to a prepared outlet without harm. Terraces in fields are generally built so they can be farmed. Terraces intended mainly for drainage have a deep channel that is maintained in permanent sod.

Terrace (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Tilth, soil. The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

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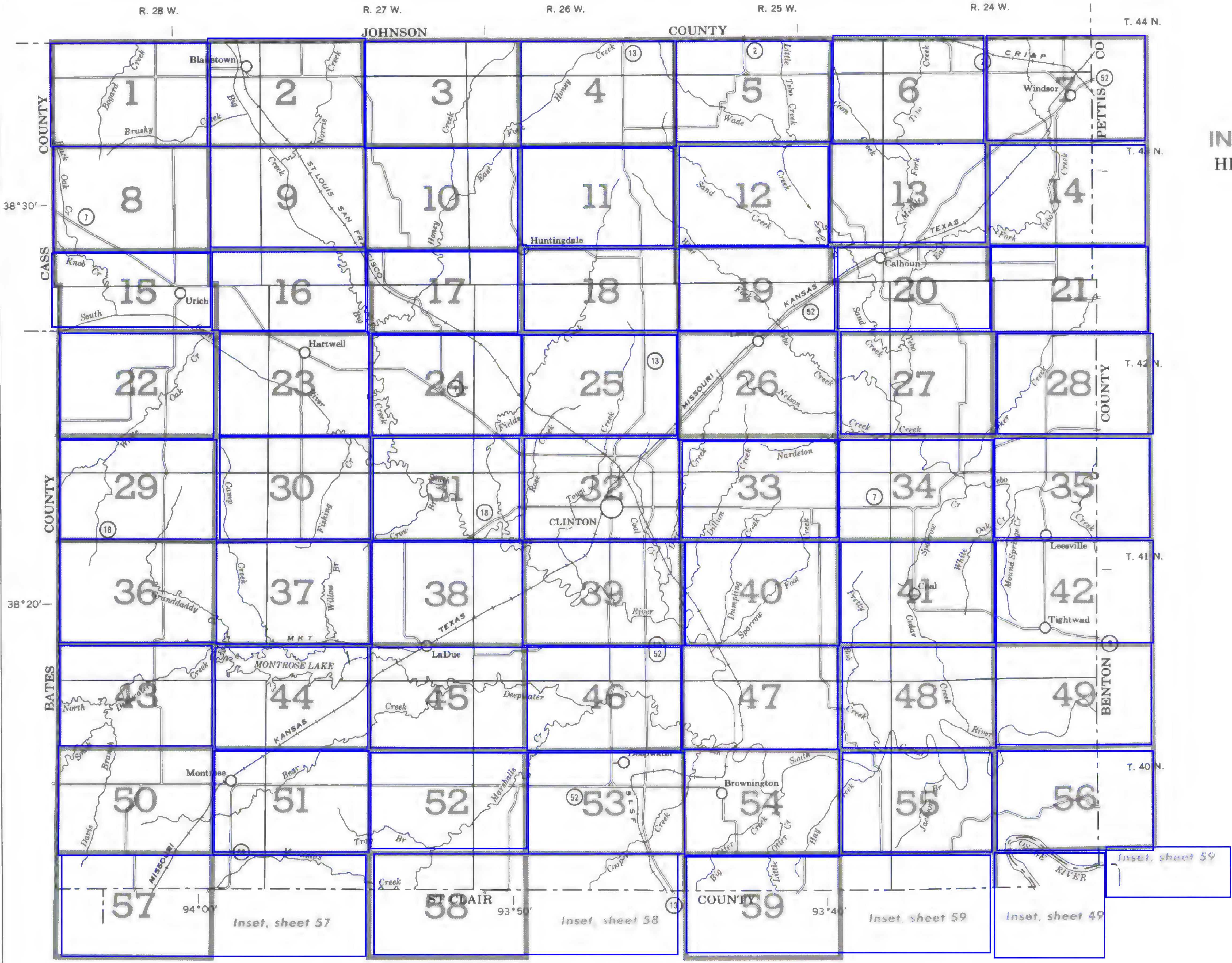
INDEX TO MAP SHEETS

HENRY COUNTY, MISSOURI

Scale 1:190,080



General Soil Map

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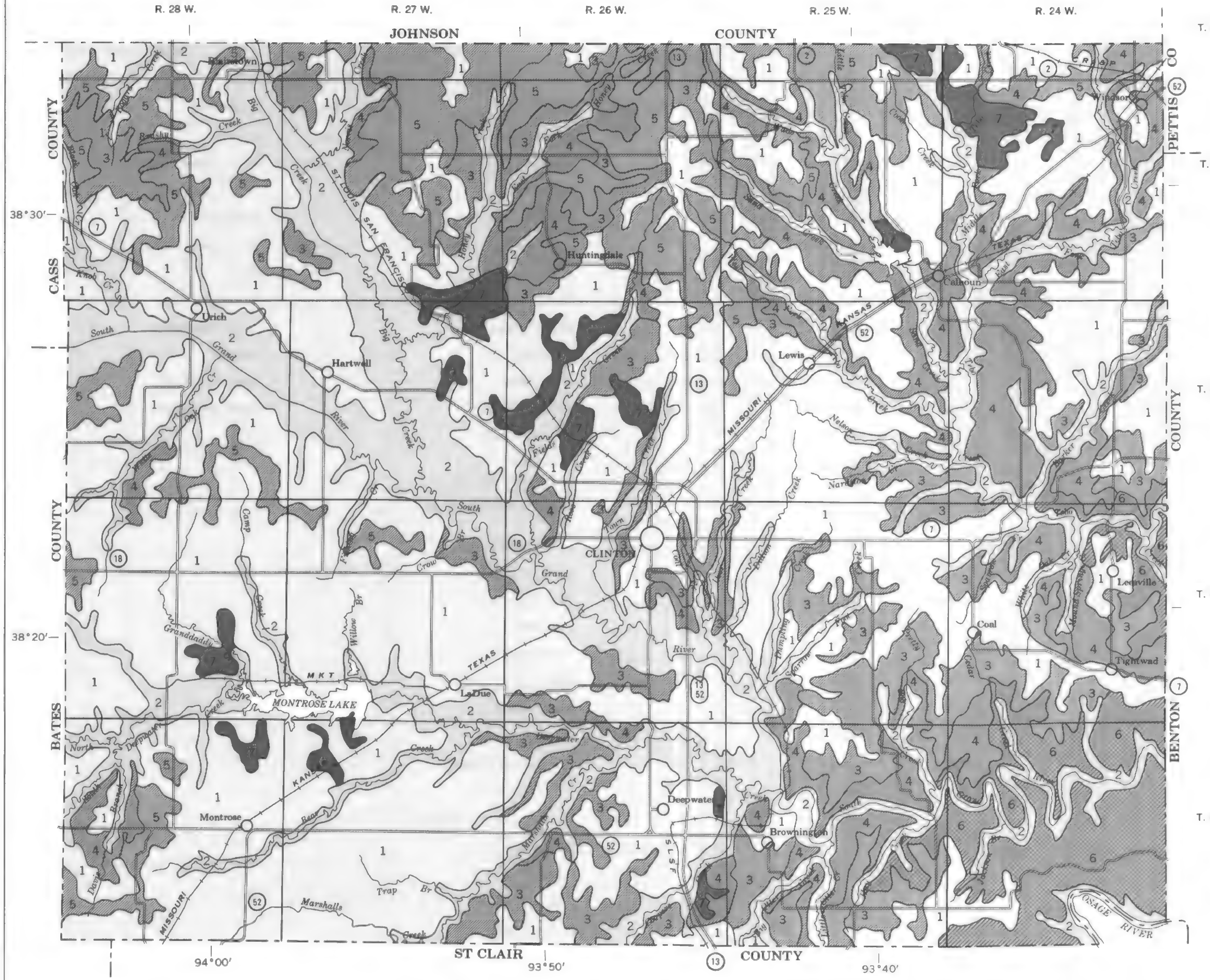
SOIL LEGEND

The first capital letter is the initial one of the soil name. The lower case letter that follows separates mapping units having names that begin with the same letter except that it does not separate sloping or eroded phases. The second capital letter indicates the class of slope. Symbols without a slope letter are those with a slope range of 0 to 2 percent or they are for land types with a considerable range of slope. A final number 2 or 3 in the symbol indicates that the soil is eroded or severely eroded respectively.

SYMBOL	NAME
BaB	Barco loam, 2 to 5 percent slopes
BaB2	Barco loam, 2 to 5 percent slopes, eroded
BaC	Barco loam, 5 to 10 percent slopes
BaC2	Barco loam, 5 to 10 percent slopes, eroded
BaC3	Barco loam, 5 to 15 percent slopes, severely eroded
BaD2	Barco loam, 10 to 20 percent slopes, eroded
BoB	Bolivar fine sandy loam, 2 to 5 percent slopes
BoB2	Bolivar fine sandy loam, 2 to 5 percent slopes, eroded
BoC2	Bolivar fine sandy loam, 5 to 10 percent slopes, eroded
BoD2	Bolivar fine sandy loam, 10 to 25 percent slopes, eroded
BrC	Bolivar-Rock land complex, 2 to 15 percent slopes
BrE	Bolivar-Rock land complex, 15 to 50 percent slopes
ChB	Cherokee silt loam, 1 to 3 percent slopes
ChB2	Cherokee silt loam, 1 to 3 percent slopes, eroded
CoC	Coweta fine sandy loam, 2 to 10 percent slopes
CoD	Coweta fine sandy loam, 10 to 25 percent slopes
CrB	Creldon silt loam, 2 to 5 percent slopes
CrC	Creldon silt loam, 5 to 10 percent slopes
CsB	Crider silt loam, 2 to 5 percent slopes
CsB2	Crider silt loam, 2 to 5 percent slopes, eroded
CsC2	Crider silt loam, 5 to 15 percent slopes, eroded
DeB	Deepwater silt loam, 2 to 5 percent slopes
DeB2	Deepwater silt loam, 2 to 5 percent slopes, eroded
DeC	Deepwater silt loam, 5 to 10 percent slopes
DeC2	Deepwater silt loam, 5 to 10 percent slopes, eroded
DpB3	Deepwater silty clay loam, 2 to 5 percent slopes, severely eroded
DpC3	Deepwater silty clay loam, 5 to 10 percent slopes, severely eroded
ElB	Eldon cherty silt loam, 2 to 5 percent slopes
ElC	Eldon cherty silt loam, 5 to 10 percent slopes
ElD	Eldon cherty silt loam, 10 to 20 percent slopes
GoC	Goss cherty silt loam, 2 to 15 percent slopes
GoD	Goss cherty silt loam, 15 to 50 percent slopes
HtA	Hartwell silt loam, 0 to 2 percent slopes
HtB	Hartwell silt loam, 2 to 4 percent slopes
HtB2	Hartwell silt loam, 2 to 5 percent slopes, eroded
HyB3	Hartwell silty clay loam, 2 to 5 percent slopes, severely eroded
Le	Lightning silt loam
MaB	Mandeville silt loam, 2 to 5 percent slopes
MaC2	Mandeville silt loam, 5 to 10 percent slopes, eroded
MaD	Mandeville silt loam, 10 to 25 percent slopes
Mp	Mine pits and dumps
Mu	Muldrow silt loam
NeB	Newtonia silt loam, 1 to 3 percent slopes
NoD2	Norris shaly loam, 10 to 25 percent slopes, eroded
Os	Osage silty clay loam
Ot	Osage silty clay loam, high bottom
Oy	Osage silty clay
Qu	Quarles silt loam
RgD	Rock land-Gasconade complex, 12 to 50 percent slopes
RoC	Roseland silt loam, 2 to 10 percent slopes
RoD	Roseland silt loam, 10 to 15 percent slopes
RsD3	Roseland shaly silt loam, 5 to 15 percent slopes, severely eroded
SnB	Snead silty clay, 2 to 5 percent slopes
SnB2	Snead silty clay, 2 to 5 percent slopes, eroded
SnC2	Snead silty clay, 5 to 15 percent slopes, eroded
SuB	Summit silty clay loam, 2 to 5 percent slopes
SuB2	Summit silty clay loam, 2 to 5 percent slopes, eroded
SuC	Summit silty clay loam, 5 to 10 percent slopes
SuC2	Summit silty clay loam, 5 to 10 percent slopes, eroded
Ur	Urich silt loam
Ve	Verdigris silt loam



U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
MISSOURI AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP

HENRY COUNTY, MISSOURI

Scale 1:190,080

1 0 1 2 3 4 Miles

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Manuscript

SOIL ASSOCIATIONS

1 Hartwell-Deepwater association: Deep, nearly level to moderately sloping, somewhat poorly drained and moderately well drained soils that formed in thin loess and the underlying residuum derived from shale

2 Verdigris-Osage association: Deep, nearly level, moderately well drained and poorly drained soils that formed in alluvium

3 Barco-Coweta association: Moderately deep and shallow, gently sloping to moderately steep, well-drained soils that formed in residuum derived from sandstone

4 Mandeville-Bolivar association: Moderately deep, gently sloping to moderately steep, well-drained soils that formed in residuum derived from shale and sandstone

5 Summit-Newtonia-Snead association: Deep to moderately deep, nearly level to strongly sloping, somewhat poorly drained to well drained soils that formed in residuum derived from shale and limestone

6 Goss-Crider-Eldon association: Deep, gently sloping to steep, well-drained soils that formed in residuum derived from cherty limestone

7 Mine pits and dumps association: A mixture of shale, sandstone, and limestone materials in steep areas where surface mining has destroyed the natural soil

Compiled 1974

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

HENRY COUNTY, MISSOURI

CONVENTIONAL SIGNS

WORKS AND STRUCTURES

ghways and roads
- Divided
- Good motor
- Poor motor
- Trail

ghway markers
- National Interstate
- U. S.
- State or county

ilroads
- Single track
- Multiple track
- Abandoned

idges and crossings
- Road
- Trail
- Railroad
- Ferry (FY)
- Ford (FORD)
- Grade
- R. R. over
- R. R. under

ildings

- School
- Church

ne and quarry (QU.)

avel pit

wer line

peline

emetery

ms

vee

nks

ell, oil or gas

rest fire or lookout station

indmill

cated object

BOUNDARIES

- National or state
- County
- Minor civil division
- Reservation
- Land grant
- Small park, cemetery, airport
- Land survey division corners

DRAINAGE

Streams, double-line
- Perennial
- Intermittent

Streams, single-line
- Perennial
- Intermittent
  - Crossable with tillage implements
  - Not crossable with tillage implements
  - Unclassified

Canals and ditches

Lakes and ponds
- Perennial (water) (w)
- Intermittent (int)

Sewage Lagoon (S.L.)

Marsh or swamp

Wet spot

Drainage end or alluvial fan

RELIEF

Escarpments
- Bedrock
- Other

Short steep slope

Prominent peak

Depressions (Large / Small)
- Crossable with tillage implements
- Not crossable with tillage implements
- Contains water most of the time

SOIL SURVEY DATA

Soil boundary and symbol (Dx)

Gravel

Stoniness
- Stony
- Very stony

Rock outcrops

Chert fragments

Clay spot

Sand spot

Gumbo or scabby spot

Made land

Severely eroded spot

Blowout, wind erosion

Gully

Welcome Page

Manuscript

Index Map

HENRY COUNTY, MISSOURI NO. 1

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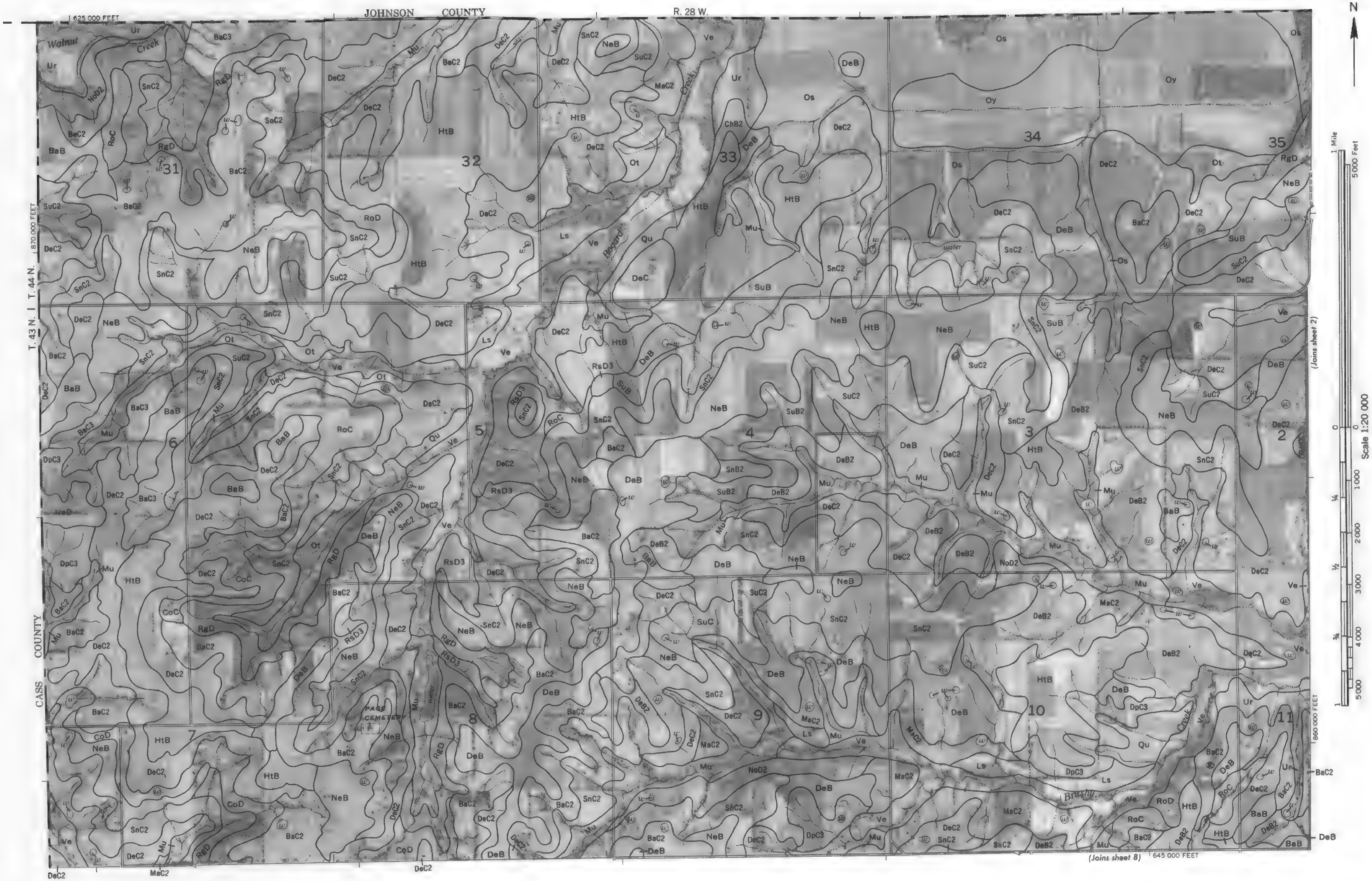
Photobase from 1971 aerial photography. Positions of 5000-foot grid ticks are approximate and based on the Missouri coordinate system, west zone.
Land division corners are approximately positioned on this map.



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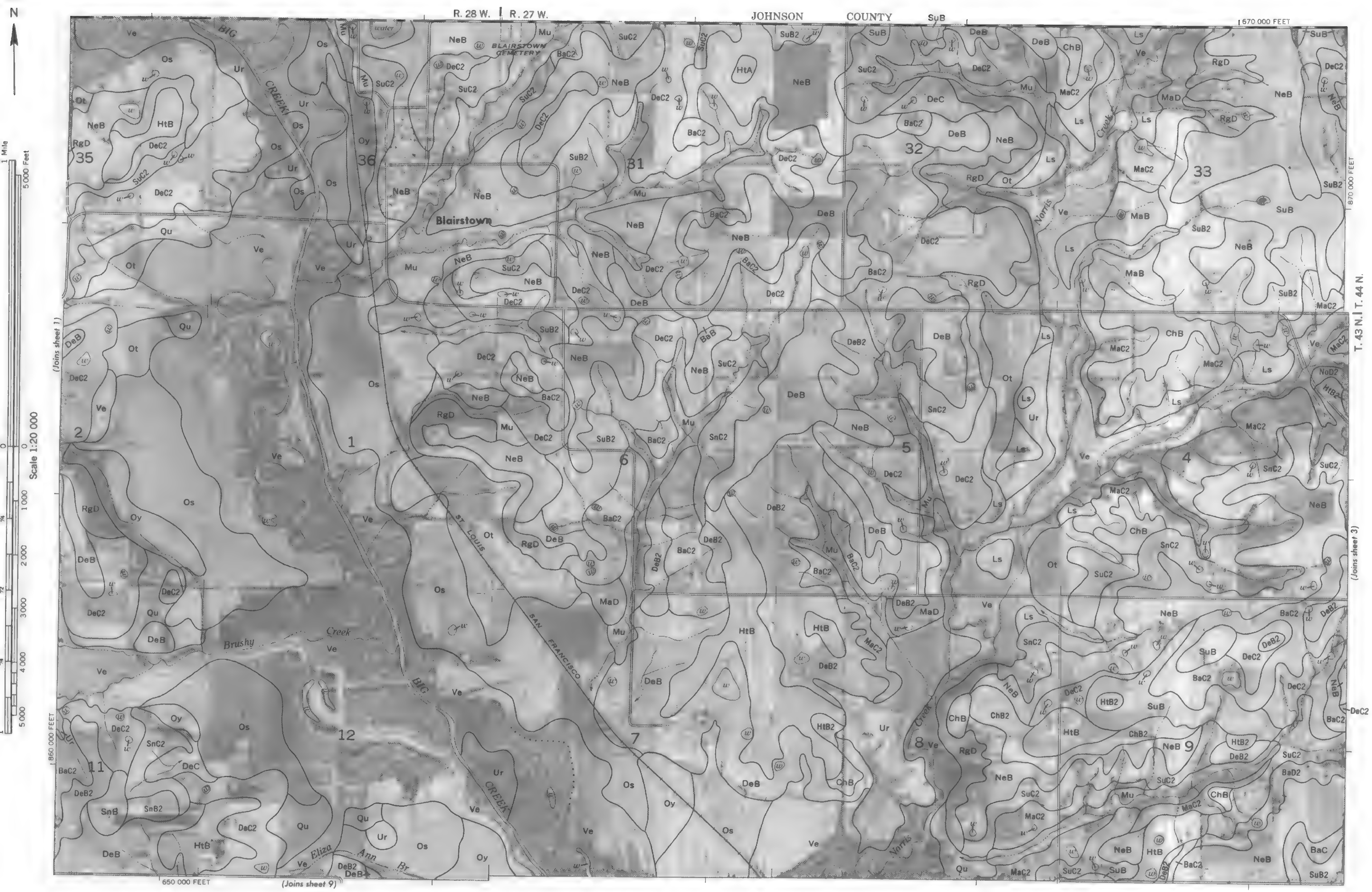

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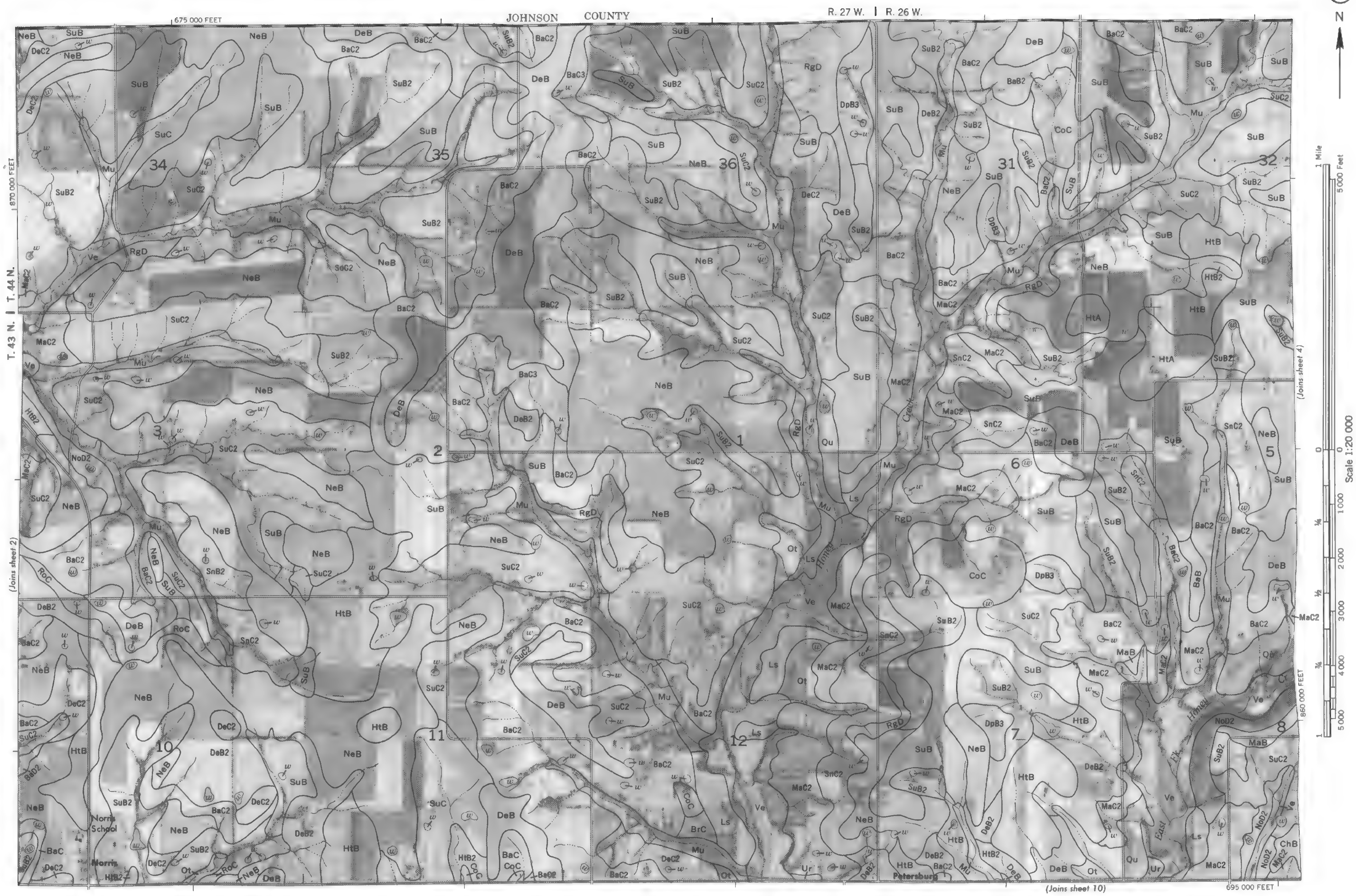
HENRY COUNTY, MISSOURI — SHEET NUMBER 3



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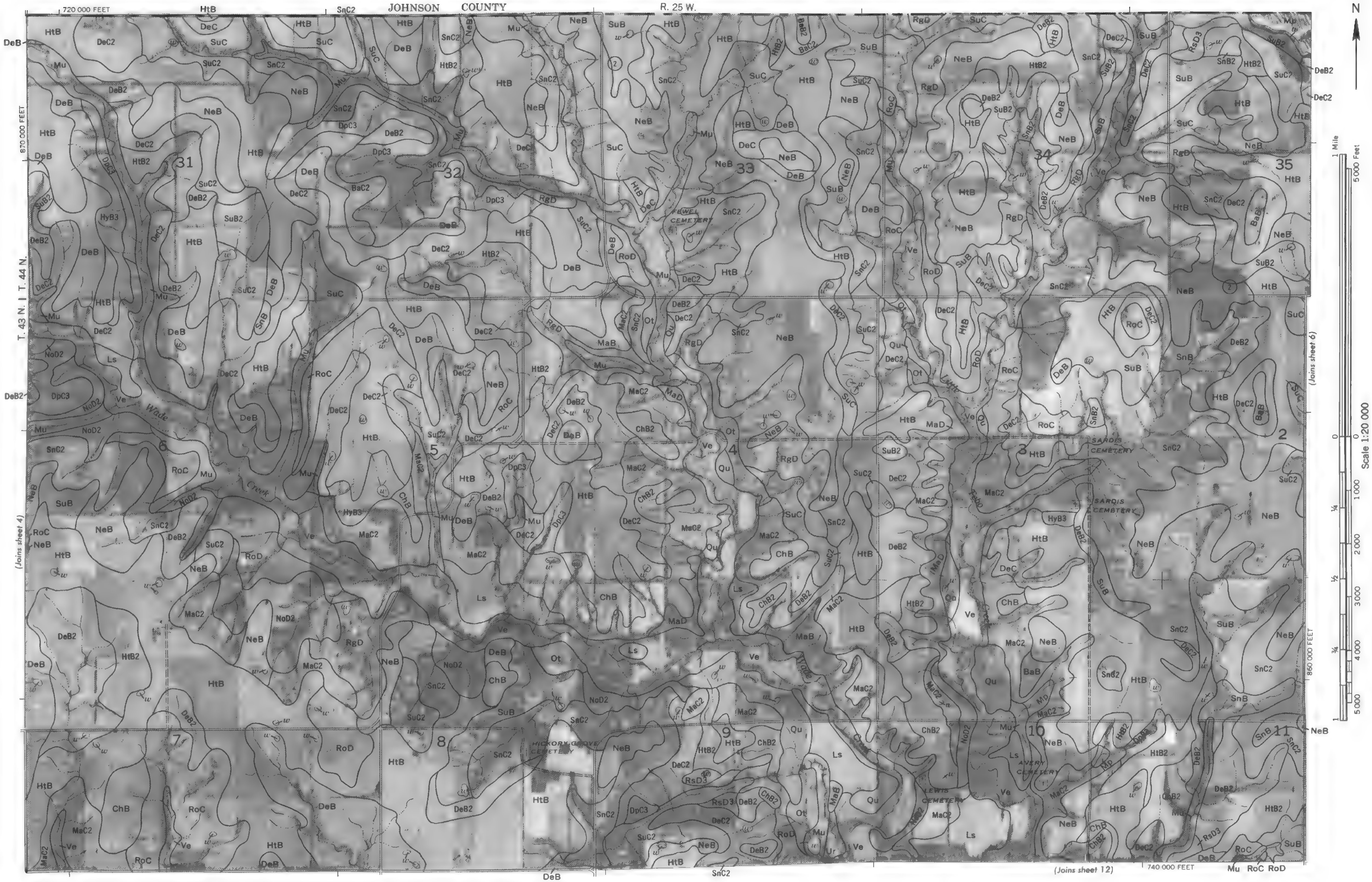
HENRY COUNTY, MISSOURI NO. 4

HENRY COUNTY, MISSOURI — SHEET NUMBER 5



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HENRY COUNTY, MISSOURI NO. 6

HENRY COUNTY, MISSOURI — SHEET NUMBER 7

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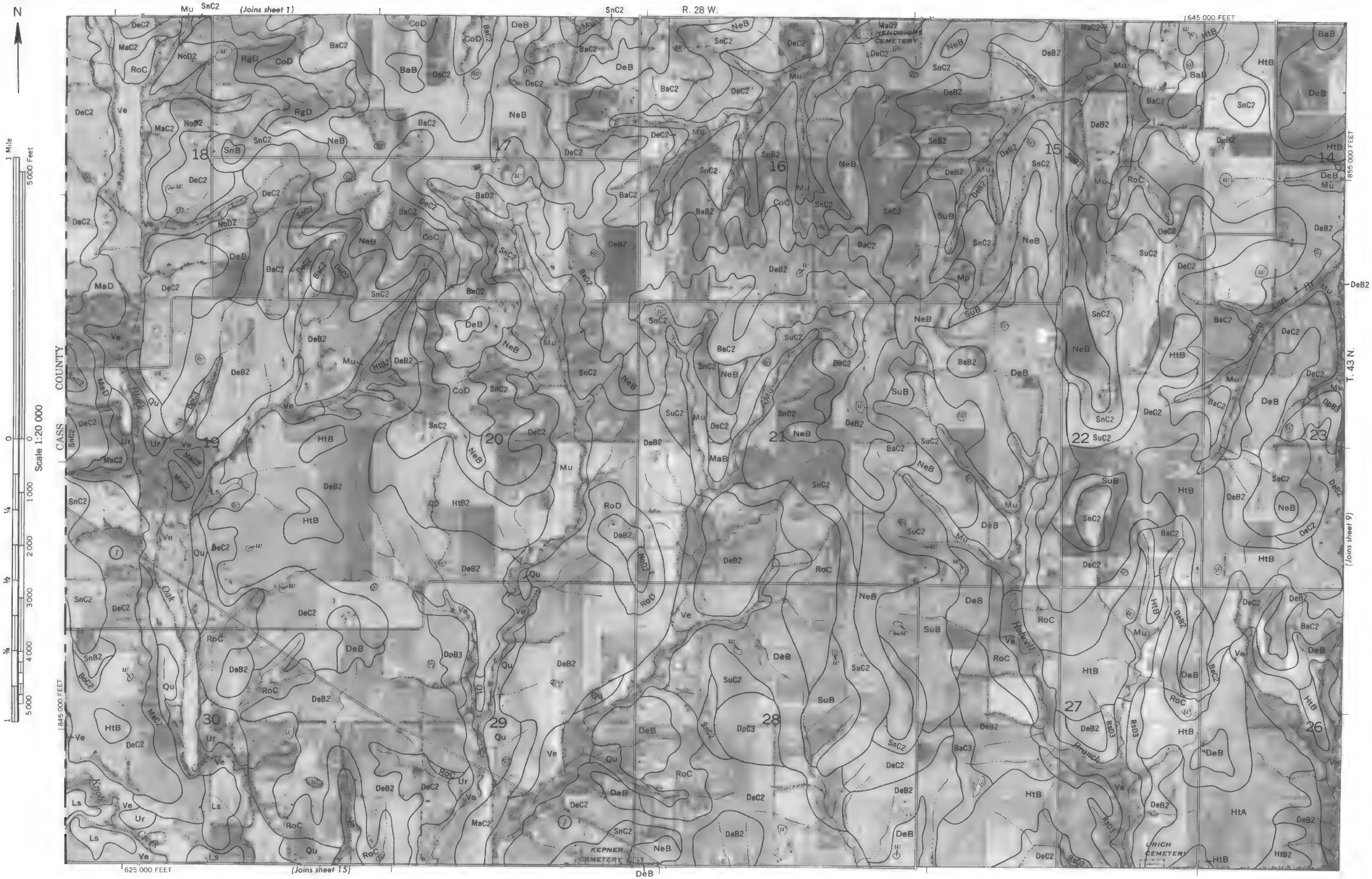
HENRY COUNTY, MISSOURI — SHEET NUMBER 8



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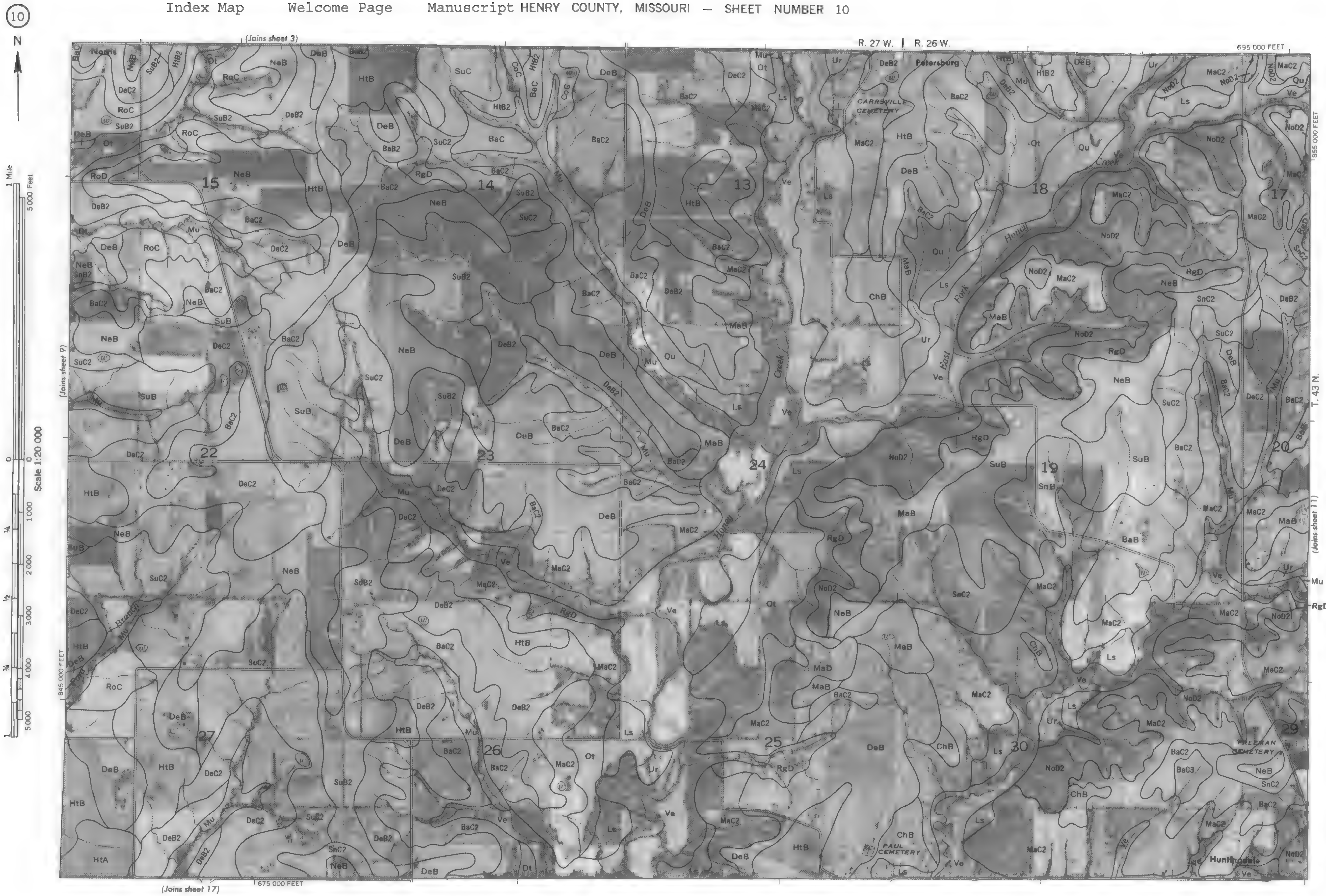

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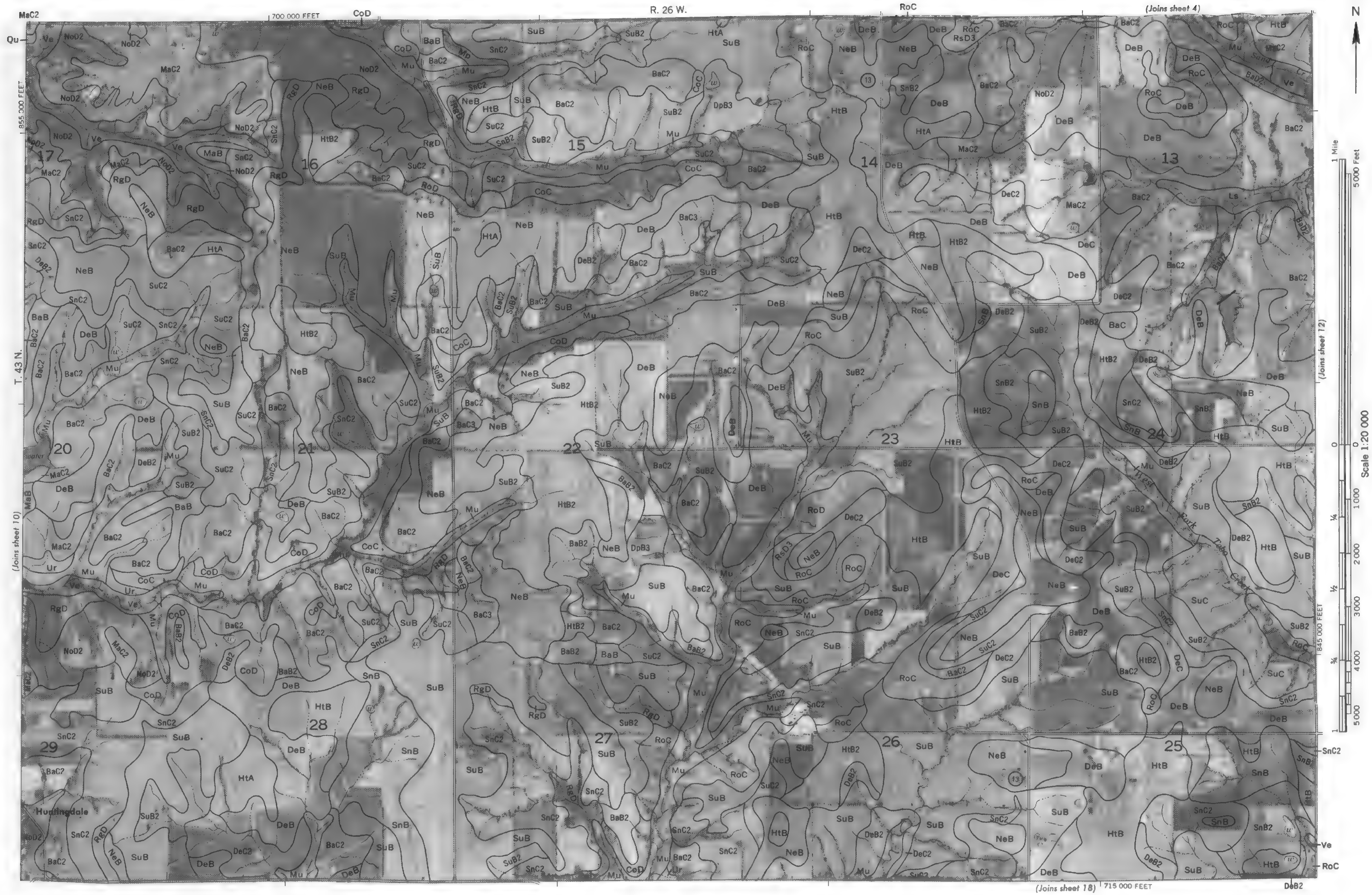

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Index Map Welcome Page Manuscript HENRY COUNTY, MISSOURI — SHEET NUMBER 12

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HENRY COUNTY, MISSOURI NO. 12

HENRY COUNTY, MISSOURI — SHEET NUMBER 13

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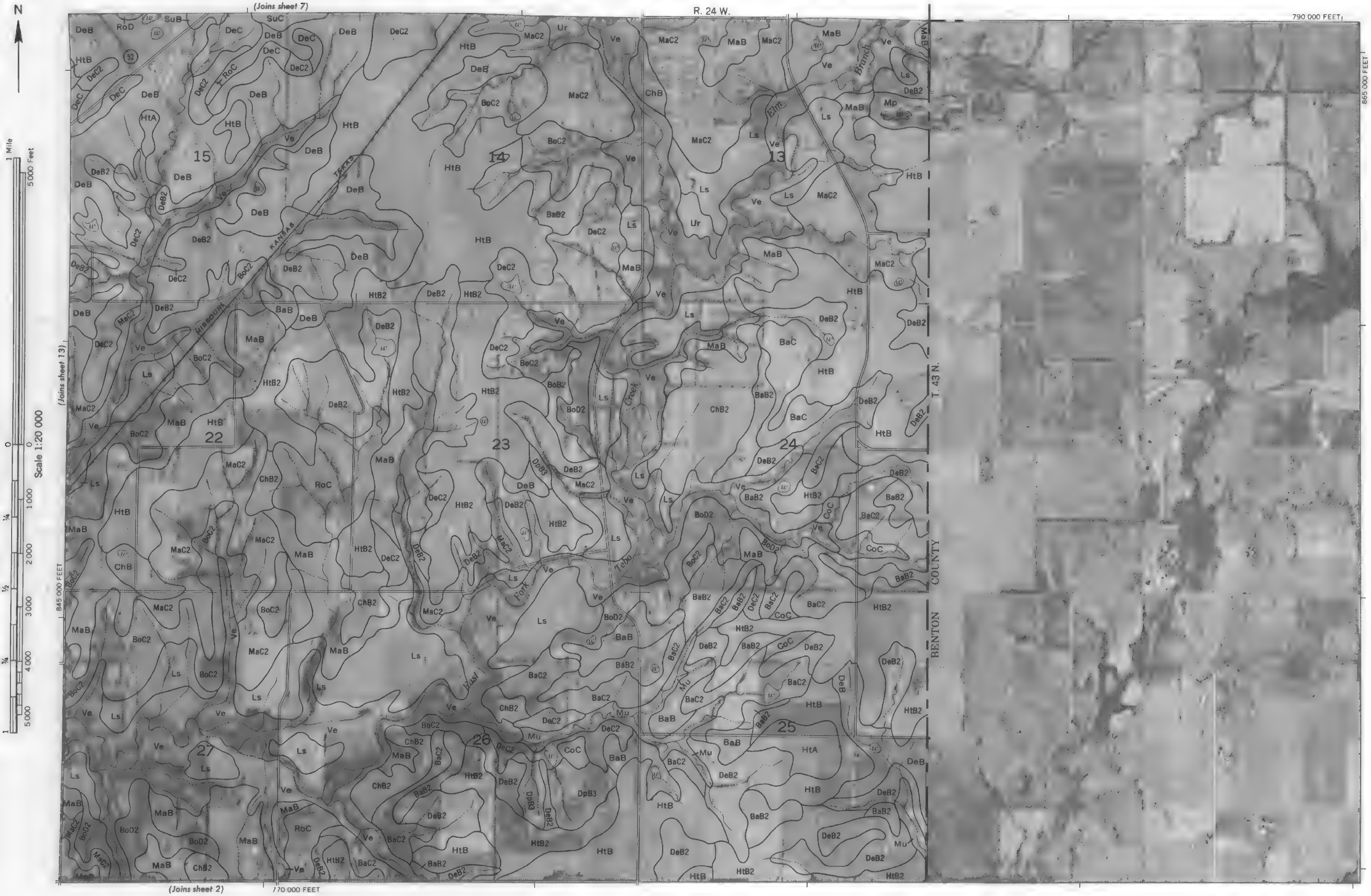
HENRY COUNTY, MISSOURI — SHEET NUMBER 14



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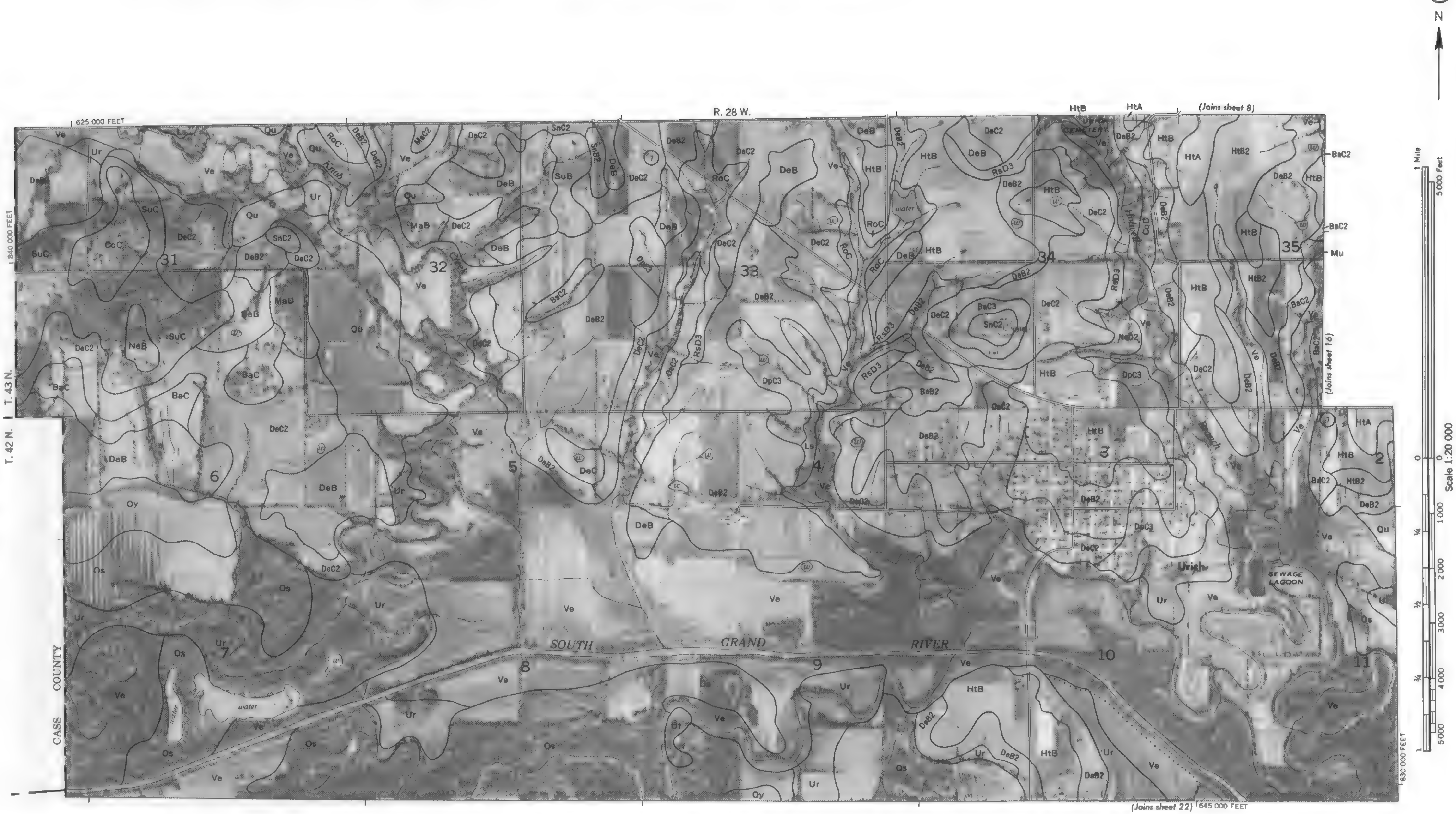
HENRY COUNTY, MISSOURI — SHEET NUMBER 15



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HENRY COUNTY, MISSOURI NO. 16

HENRY COUNTY, MISSOURI — SHEET NUMBER 17

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HENRY COUNTY, MISSOURI NO. 17

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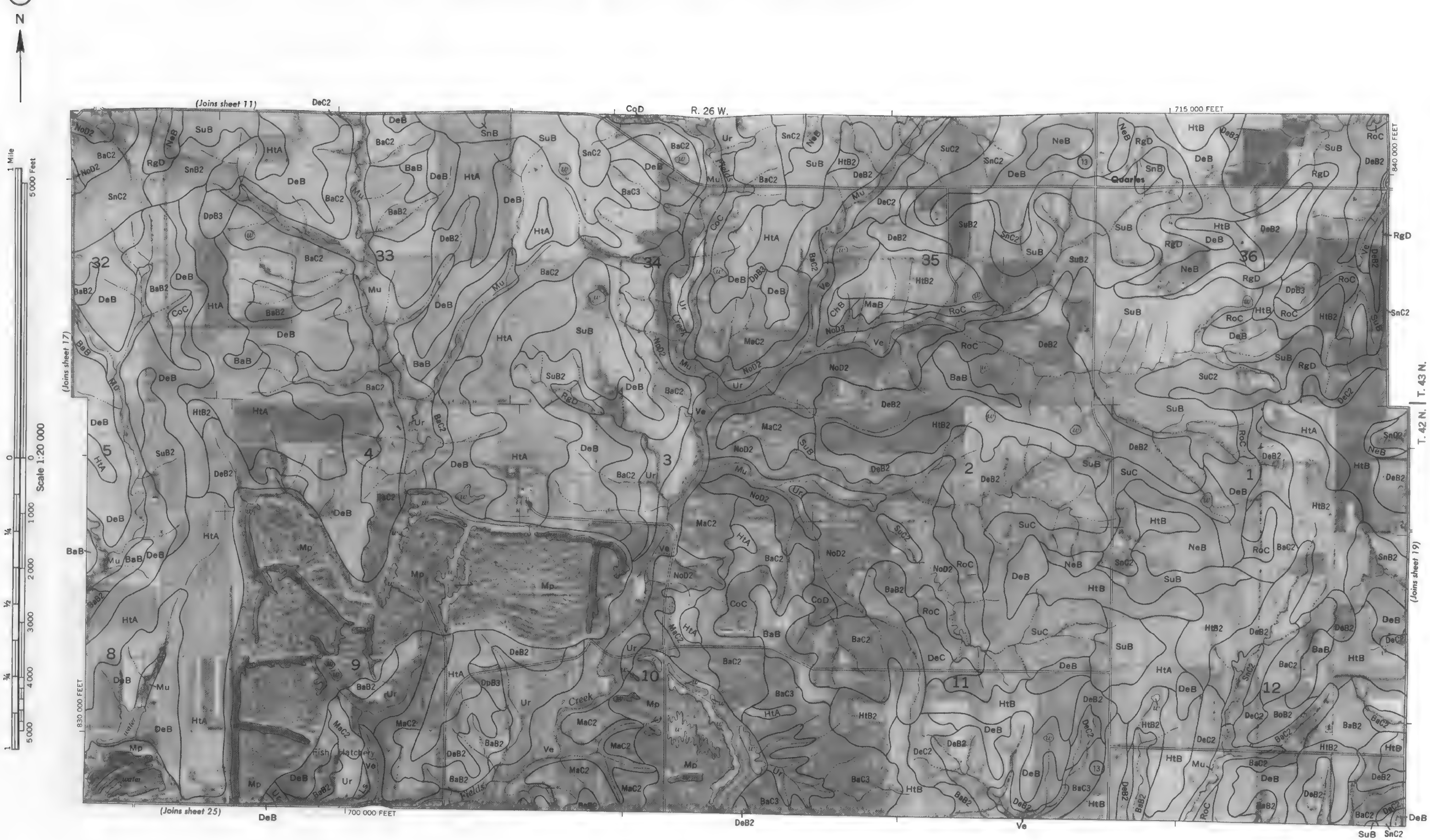

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HENRY COUNTY, MISSOURI NO. 18

N

1 Mile

5 000 Feet

Scale 1:20 000

HENRY COUNTY, MISSOURI NO. 19

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HENRY COUNTY, MISSOURI — SHEET NUMBER 20

HENRY COUNTY, MISSOURI — SHEET NUMBER 21

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N

HENRY COUNTY, MISSOURI NO. 21

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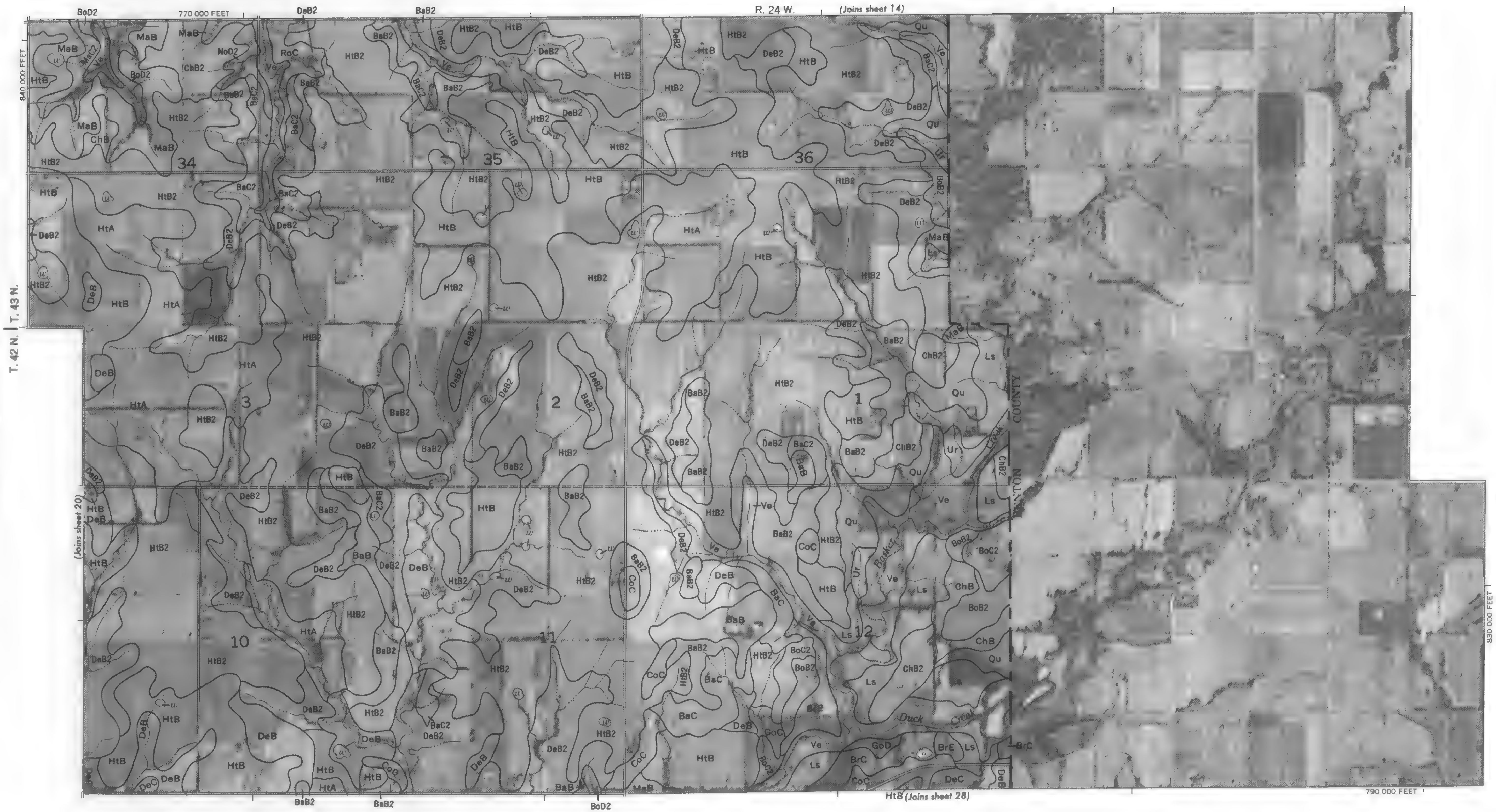

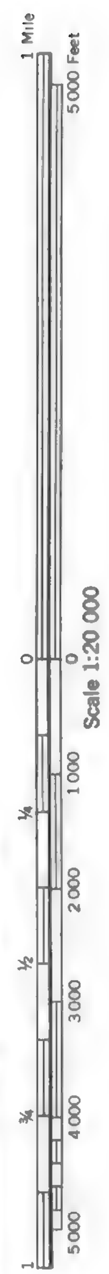

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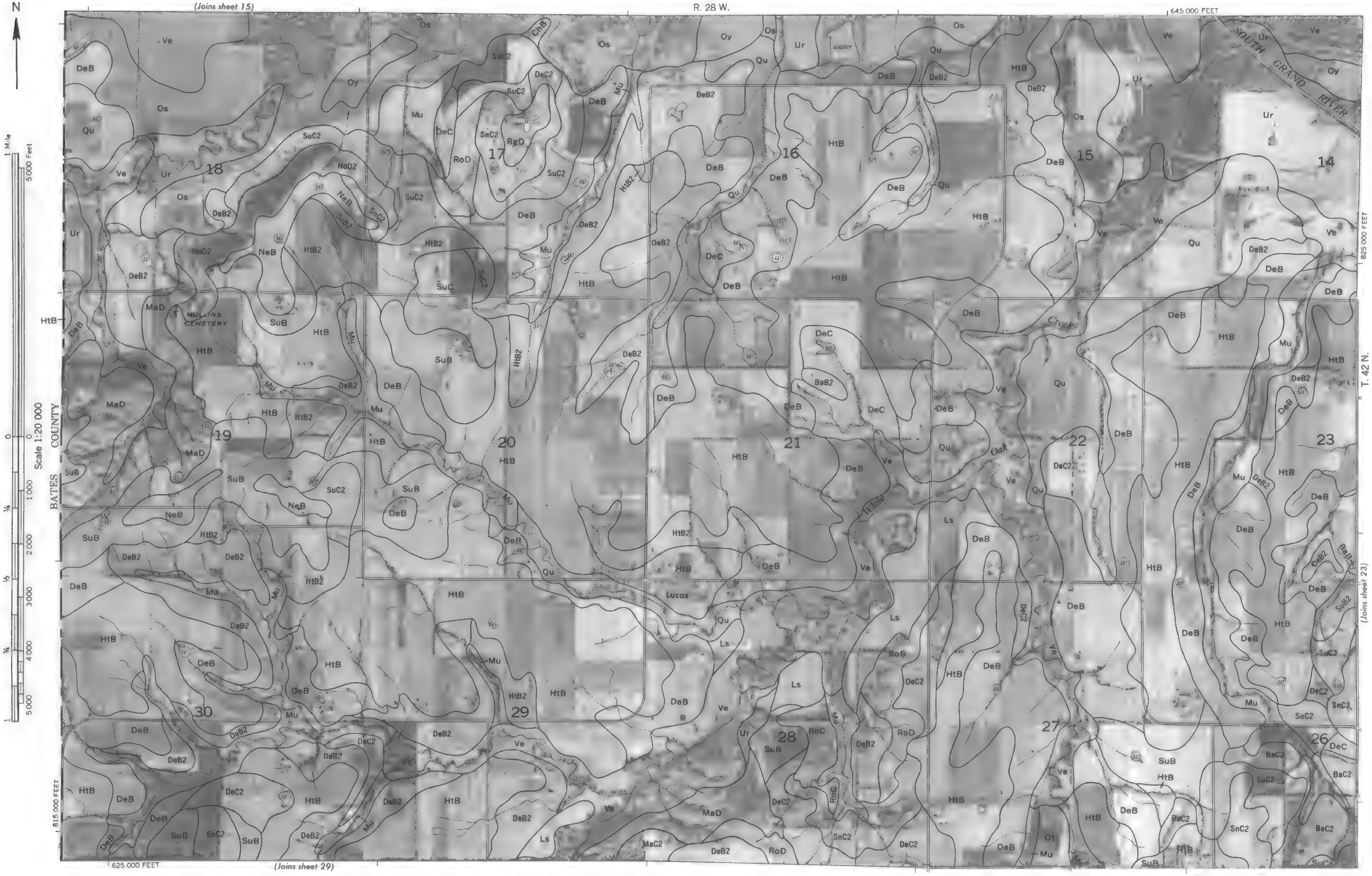

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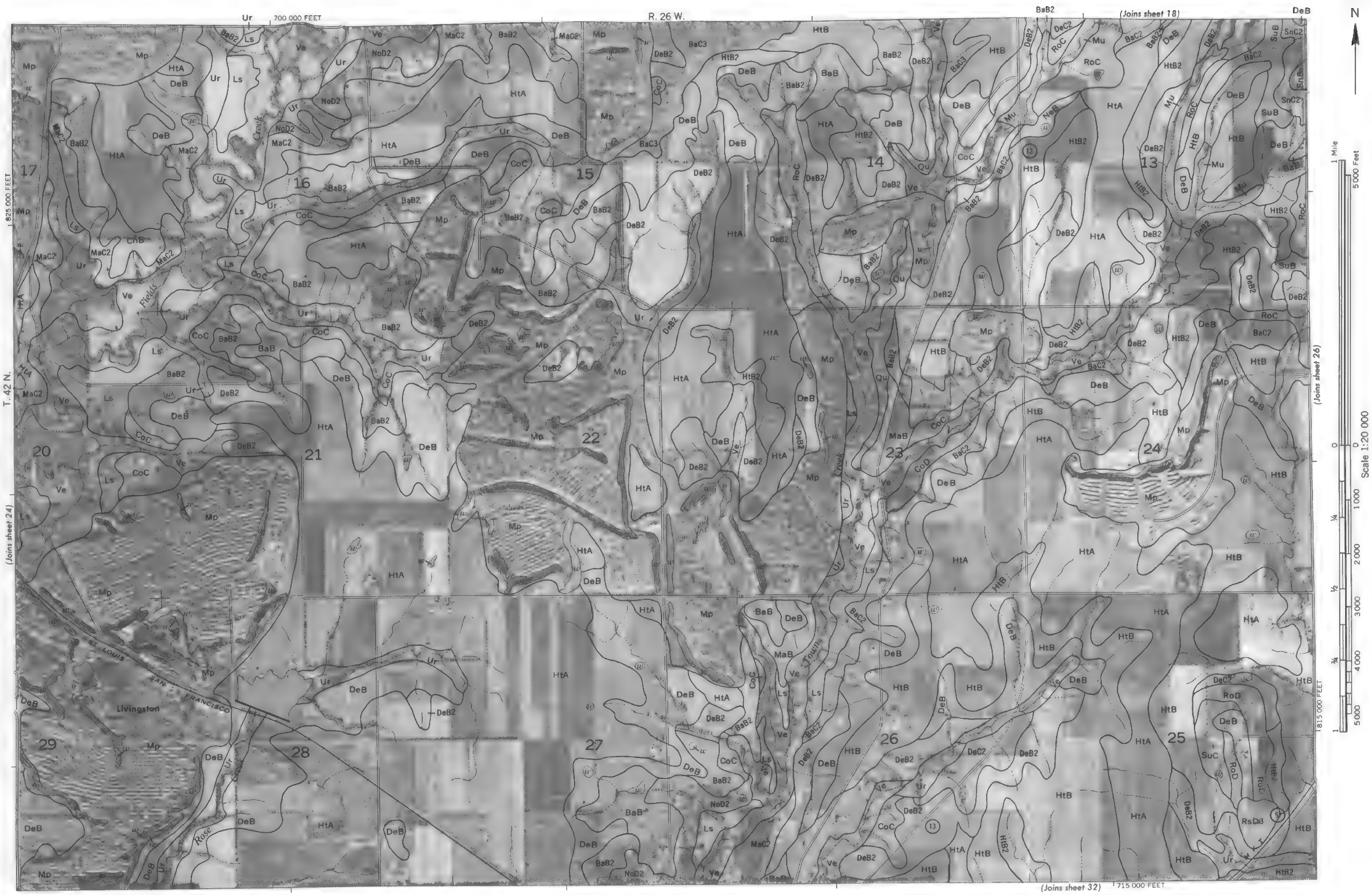
HENRY COUNTY, MISSOURI — SHEET NUMBER 25



HENRY COUNTY, MISSOURI NO. 25

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Missouri Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 5000-foot grid ticks are approximate and based on the Missouri coordinate system, west zone.
Land division corners are approximately positioned on this map.

HENRY COUNTY, MISSOURI — SHEET NUMBER 26

Land division corners are approximately positioned on this map.

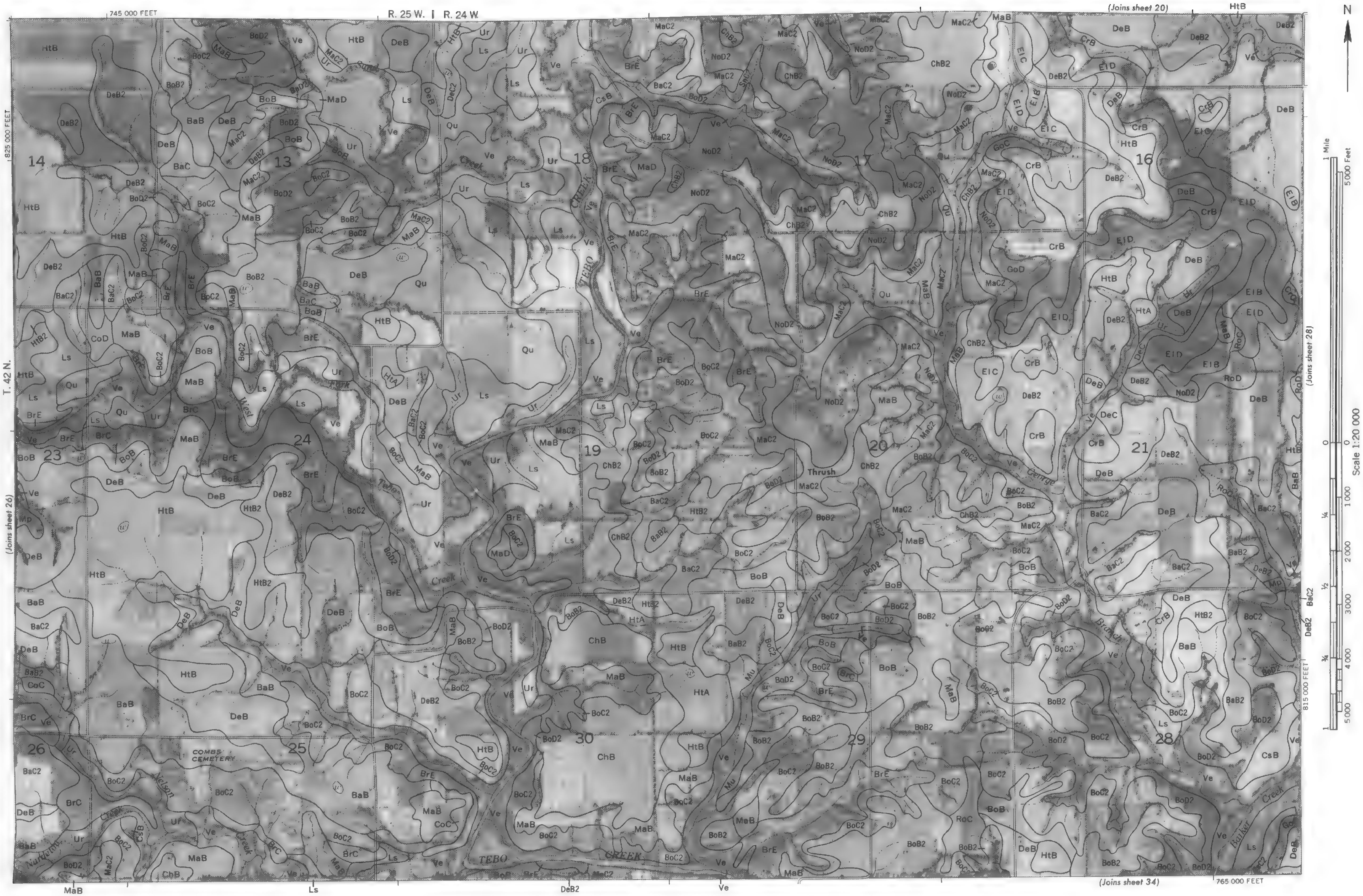
Photobase from 1971 aerial photography. Positions of 5000-foot grid ticks are approximate and based on the Missouri coordinate system, west zone.

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Missouri Agricultural Experiment Station.

HENRY COUNTY, MISSOURI NO. 26

HENRY COUNTY, MISSOURI — SHEET NUMBER 27

27



HENRY COUNTY, MISSOURI NO. 27

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Missouri Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 5000-foot grid ticks are approximate and based on the Missouri coordinate system, west zone.
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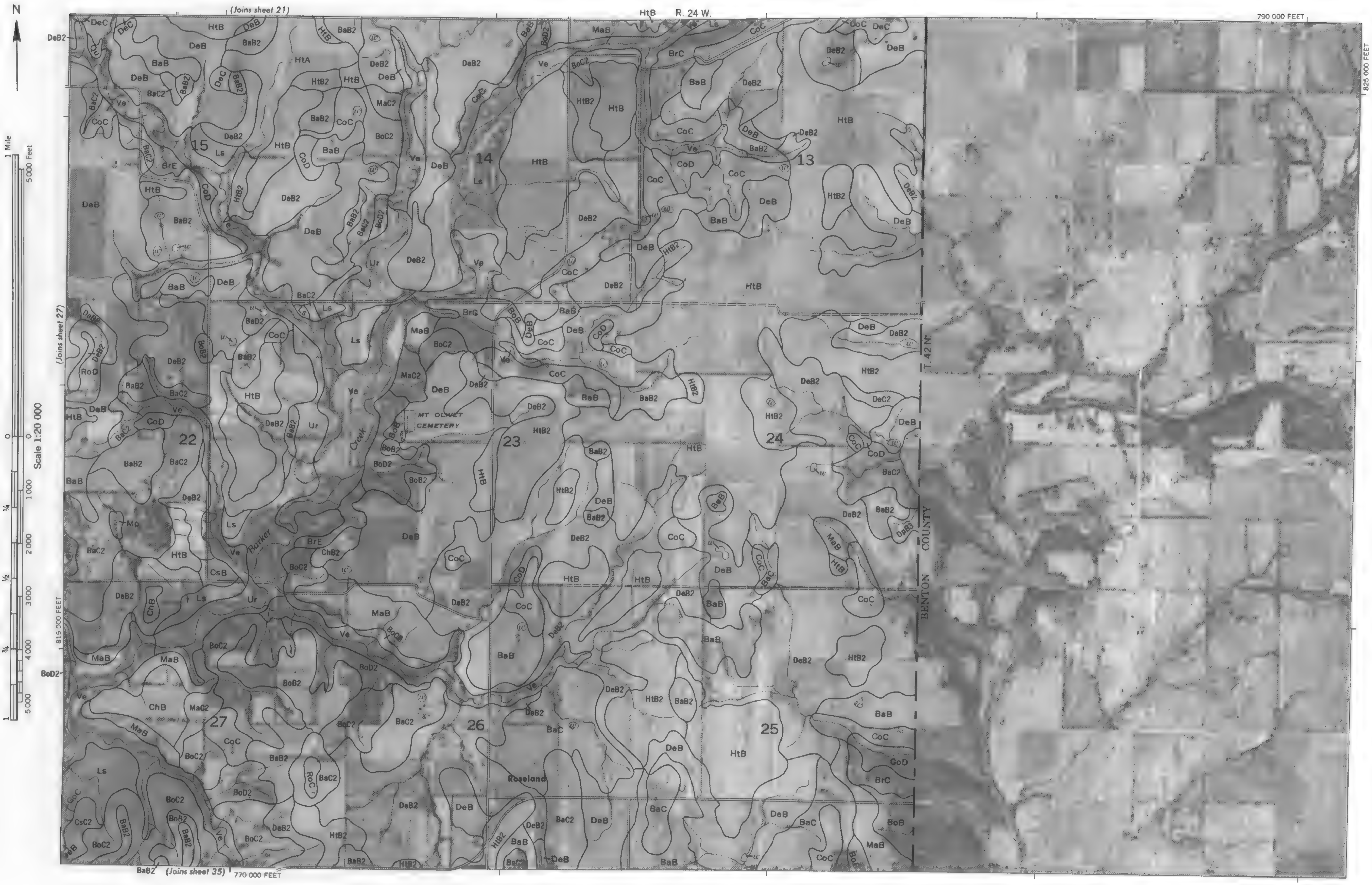

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Photobase from 1971 aerial photography. Positions of 5000-foot grid ticks are approximate and based on the Missouri coordinate system, west zone.
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HENRY COUNTY, MISSOURI NO. 28

HENRY COUNTY, MISSOURI — SHEET NUMBER 29

HENRY COUNTY, MISSOURI NO. 29

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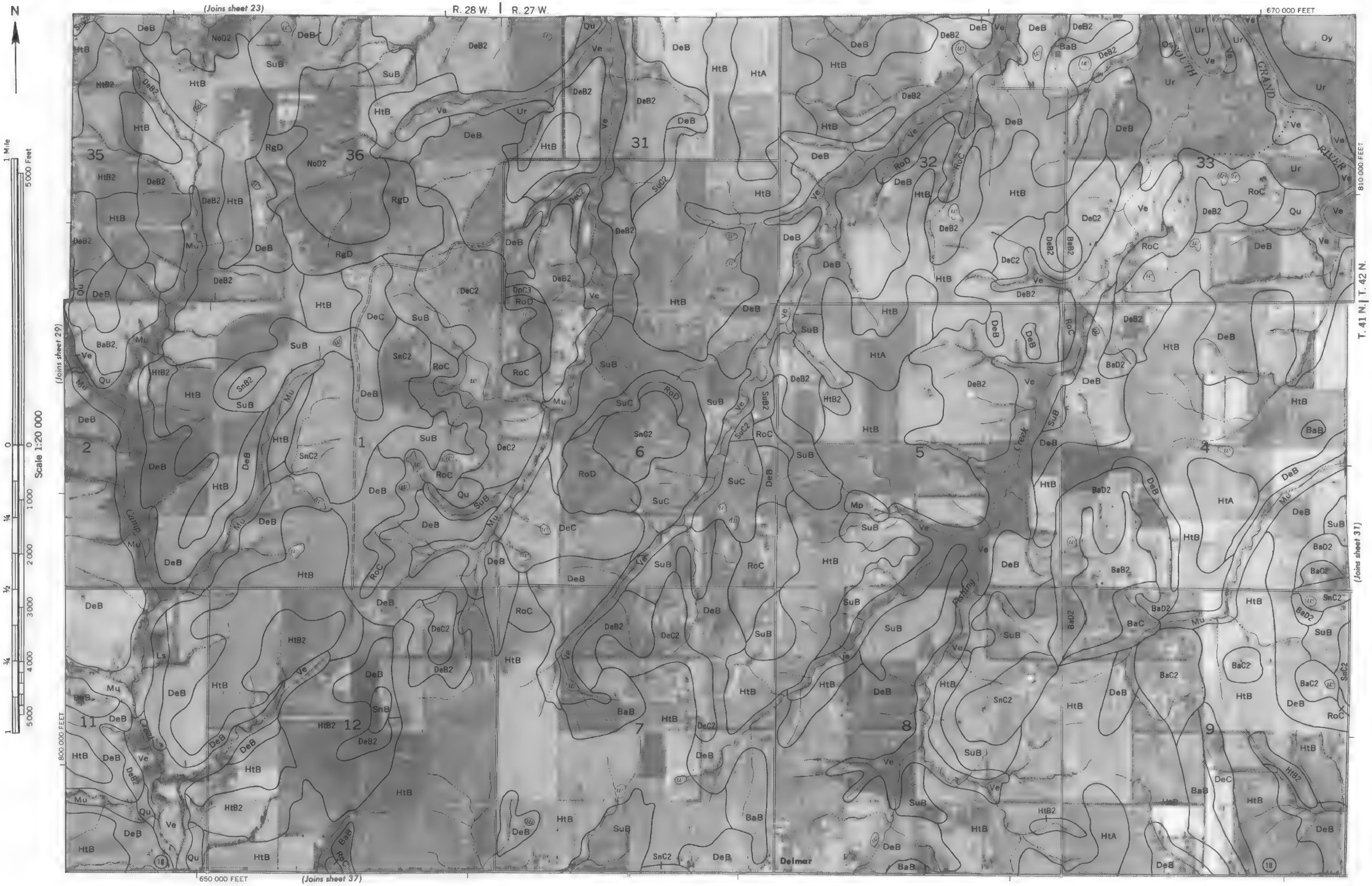
HENRY COUNTY, MISSOURI — SHEET NUMBER 30



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Photobase from 1971 aerial photography. Positions of 5000-foot grid ticks are approximate and based on the Missouri coordinate system, west zone.
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HENRY COUNTY, MISSOURI NO. 30

HENRY COUNTY, MISSOURI — SHEET NUMBER 31

HENRY COUNTY, MISSOURI NO. 31
This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Missouri Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 5000-foot grid ticks are approximate and based on the Missouri coordinate system, west zone.
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HENRY COUNTY, MISSOURI NO. 32

HENRY COUNTY, MISSOURI — SHEET NUMBER 33

HENRY COUNTY, MISSOURI NO. 33

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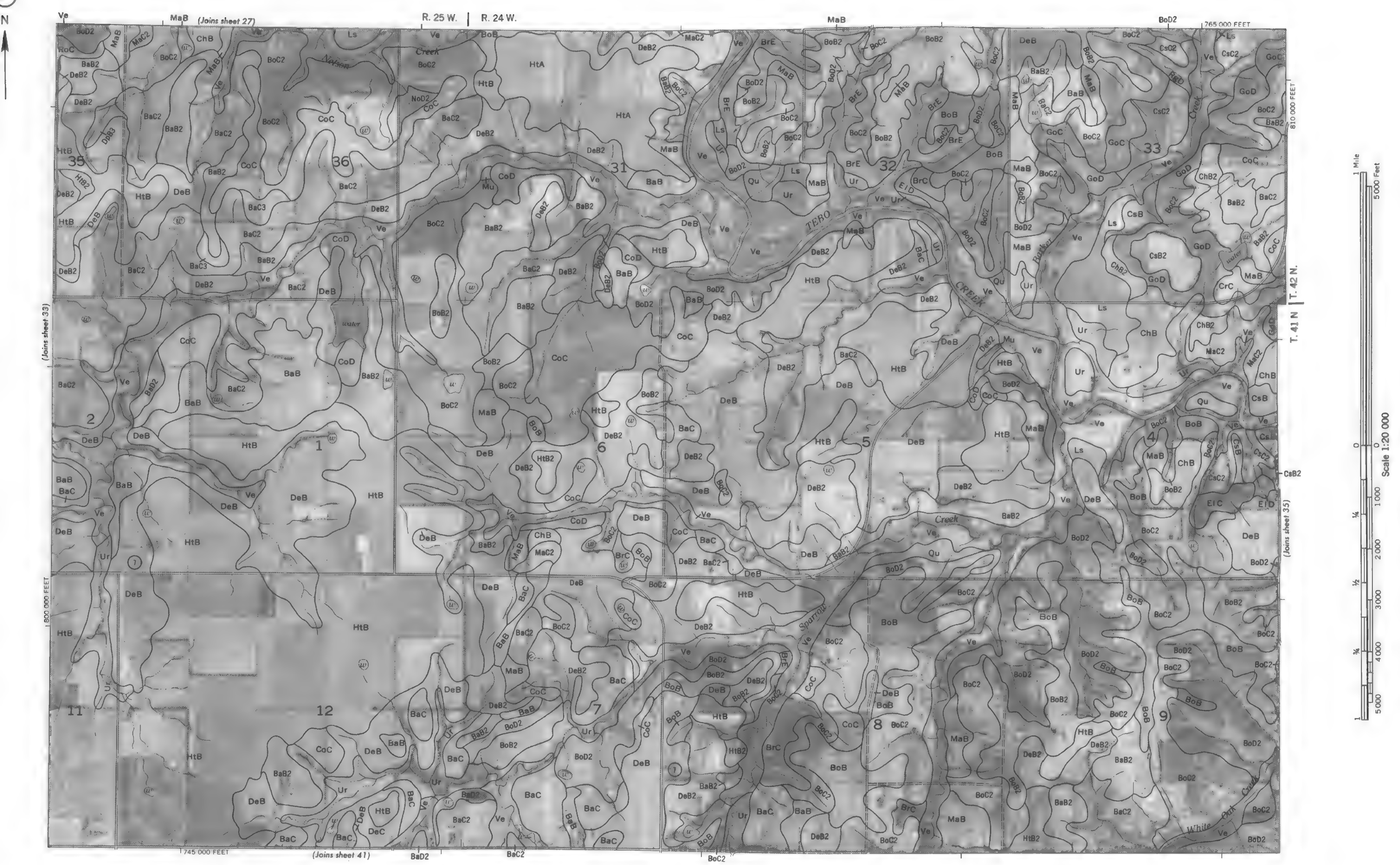

HENRY COUNTY, MISSOURI NO. 34

HENRY COUNTY, MISSOURI NO. 35

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Missouri Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 5000-foot grid ticks are approximate and based on the Missouri coordinate system, west zone.
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HENRY COUNTY, MISSOURI — SHEET NUMBER 36

Land division corners are approximately positioned on this map.

Photobase from 1971 aerial photography. Positions of 5000-foot grid ticks are approximate and based on the Missouri coordinate system, west zone.

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Missouri Agricultural Experiment Station.

HENRY COUNTY, MISSOURI NO. 36

HENRY COUNTY, MISSOURI — SHEET NUMBER 37

HENRY COUNTY, MISSOURI NO. 37

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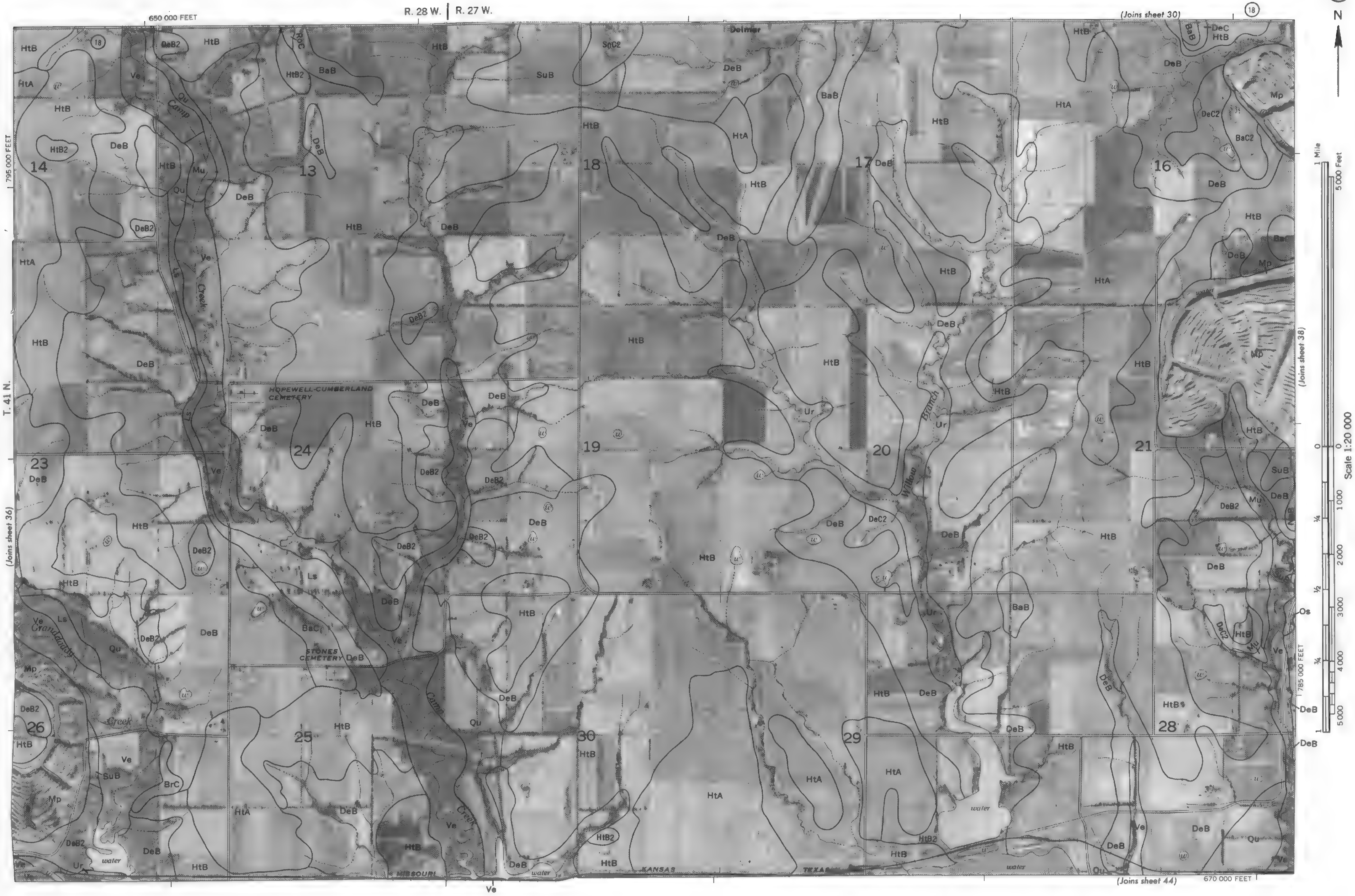

Land division corners are approximately positioned on this map.

Photobase from 1971 aerial photography. Positions of 5000-foot grid ticks are approximate and based on the Missouri coordinate system, west zone.

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Missouri Agricultural Experiment Station.

HENRY COUNTY, MISSOURI NO. 38

HENRY COUNTY, MISSOURI — SHEET NUMBER 39

HENRY COUNTY, MISSOURI NO. 39

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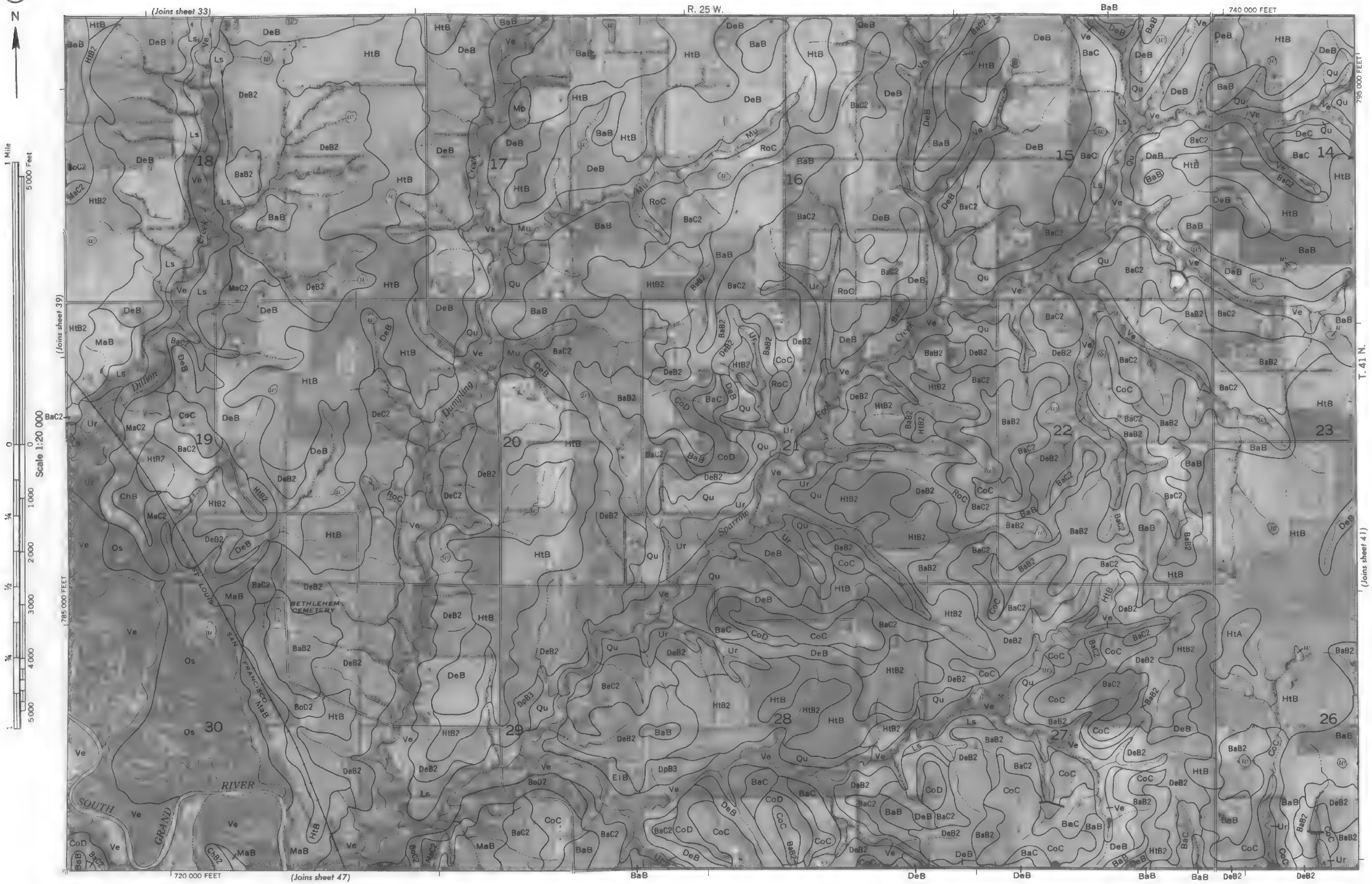
Index Map Welcome Page Manuscript HENRY COUNTY, MISSOURI — SHEET NUMBER 40



Land division corners are approximately positioned on this map.

Photobase from 1971 aerial photography. Positions of 5000-foot grid ticks are approximate and based on the Missouri coordinate system, west zone.

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HENRY COUNTY, MISSOURI NO. 40

HENRY COUNTY, MISSOURI NO. 41

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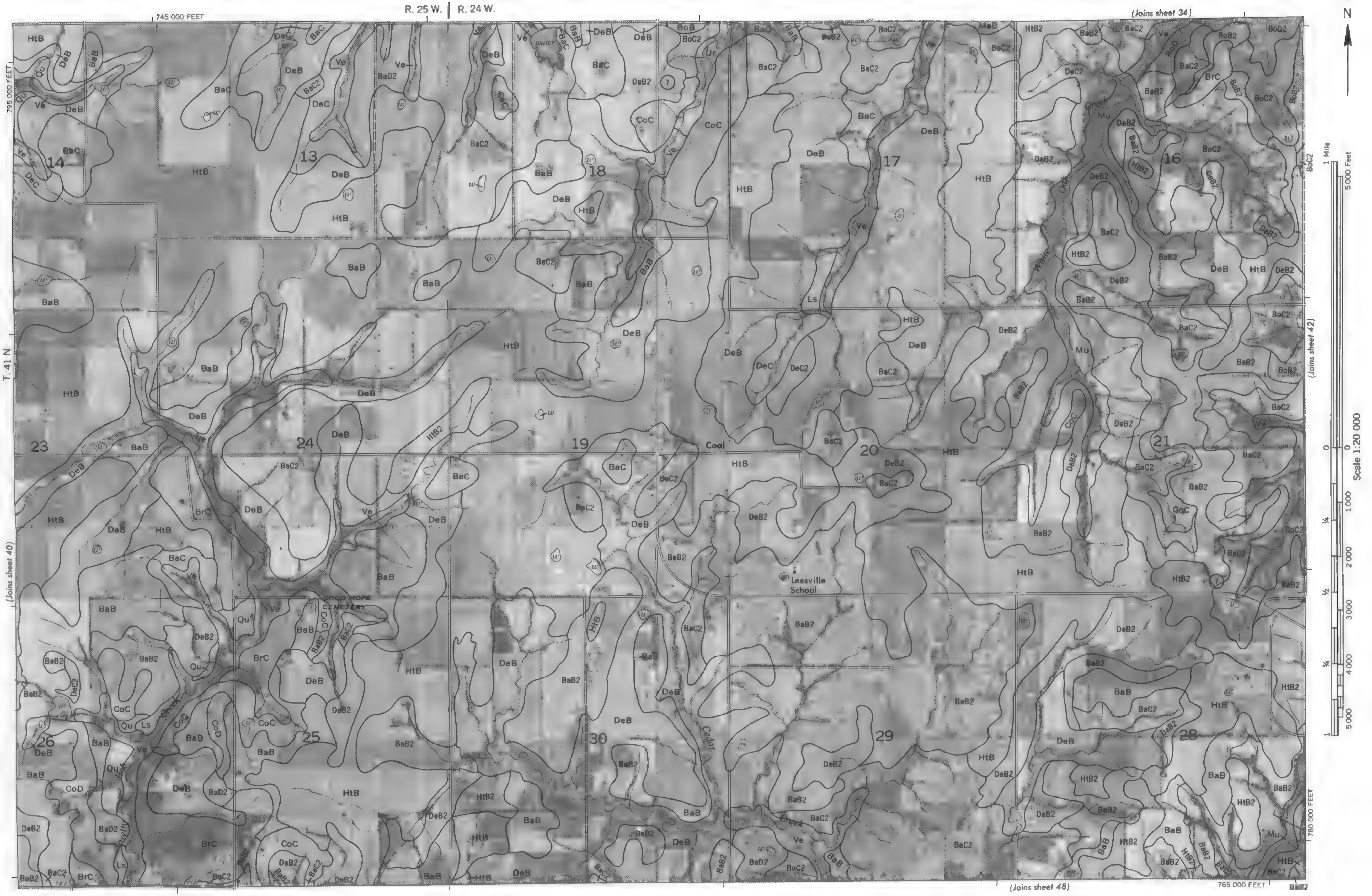
Photobase from 1971 aerial photography. Positions of 5000-foot grid ticks are approximate and based on the Missouri coordinate system, west zone.

Land division corners are approximately positioned on this map.



HENRY COUNTY, MISSOURI — SHEET NUMBER 42

Land division corners are approximately positioned on this map.

Photobase from 1971 aerial photography. Positions of 5000-foot grid ticks are approximate and based on the Missouri coordinate system, west zone.

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Missouri Agricultural Experiment Station.

HENRY COUNTY, MISSOURI — SHEET NUMBER 43

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Missouri Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 5000-foot grid ticks are approximate and based on the Missouri coordinate system, west zone.
Land division corners are approximately positioned on this map.

HENRY COUNTY, MISSOURI — SHEET NUMBER 44

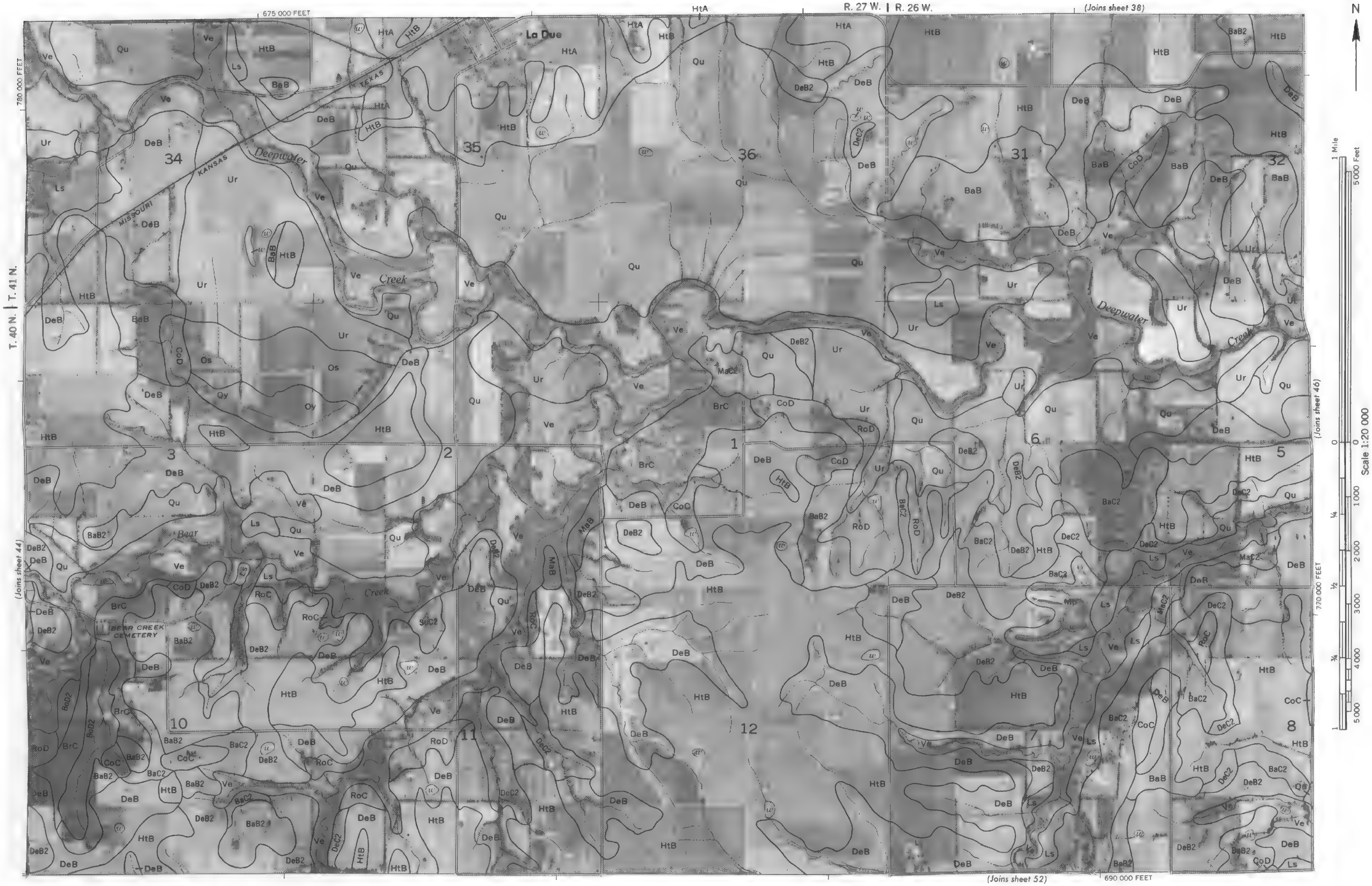
Land division corners are approximately positioned on this map.

Photobase from 1971 aerial photography. Positions of 5000-foot grid ticks are approximate and based on the Missouri coordinate system, west zone.

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Missouri Agricultural Experiment Station.

HENRY COUNTY, MISSOURI NO. 44

HENRY COUNTY, MISSOURI — SHEET NUMBER 45



HENRY COUNTY, MISSOURI NO. 45

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Missouri Agricultural Experiment Station. Photobase from 1971 aerial photography. Positions of 5000-foot grid ticks are approximate and based on the Missouri coordinate system, west zone. Land division corners are approximately positioned on this map.

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HENRY COUNTY, MISSOURI NO. 46

HENRY COUNTY, MISSOURI — SHEET NUMBER 47

HENRY COUNTY, MISSOURI NO. 47

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Missouri Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 5000-foot grid ticks are approximate and based on the Missouri coordinate system, west zone.
Land division corners are approximately positioned on this map

HENRY COUNTY, MISSOURI — SHEET NUMBER 48

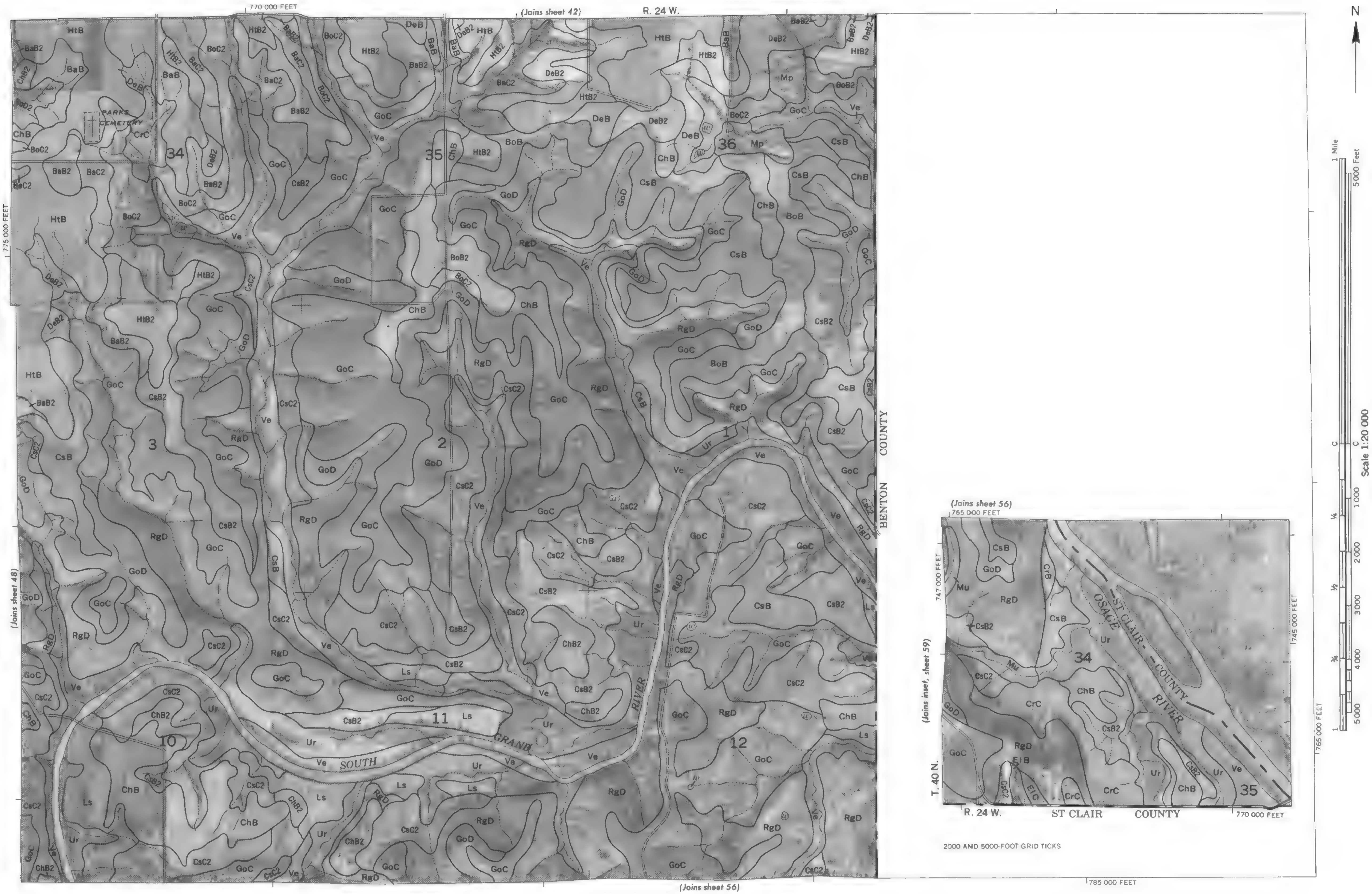
Land division corners are approximately positioned on this map.

Photobase from 1971 aerial photography. Positions of 5000-foot grid ticks are approximate and based on the Missouri coordinate system, west zone.

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Missouri Agricultural Experiment Station.

HENRY COUNTY, MISSOURI NO. 48

HENRY COUNTY, MISSOURI — SHEET NUMBER 49



This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Missouri Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 5000-foot grid ticks are approximate and based on the Missouri coordinate system, west zone.
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HENRY COUNTY, MISSOURI NO. 49

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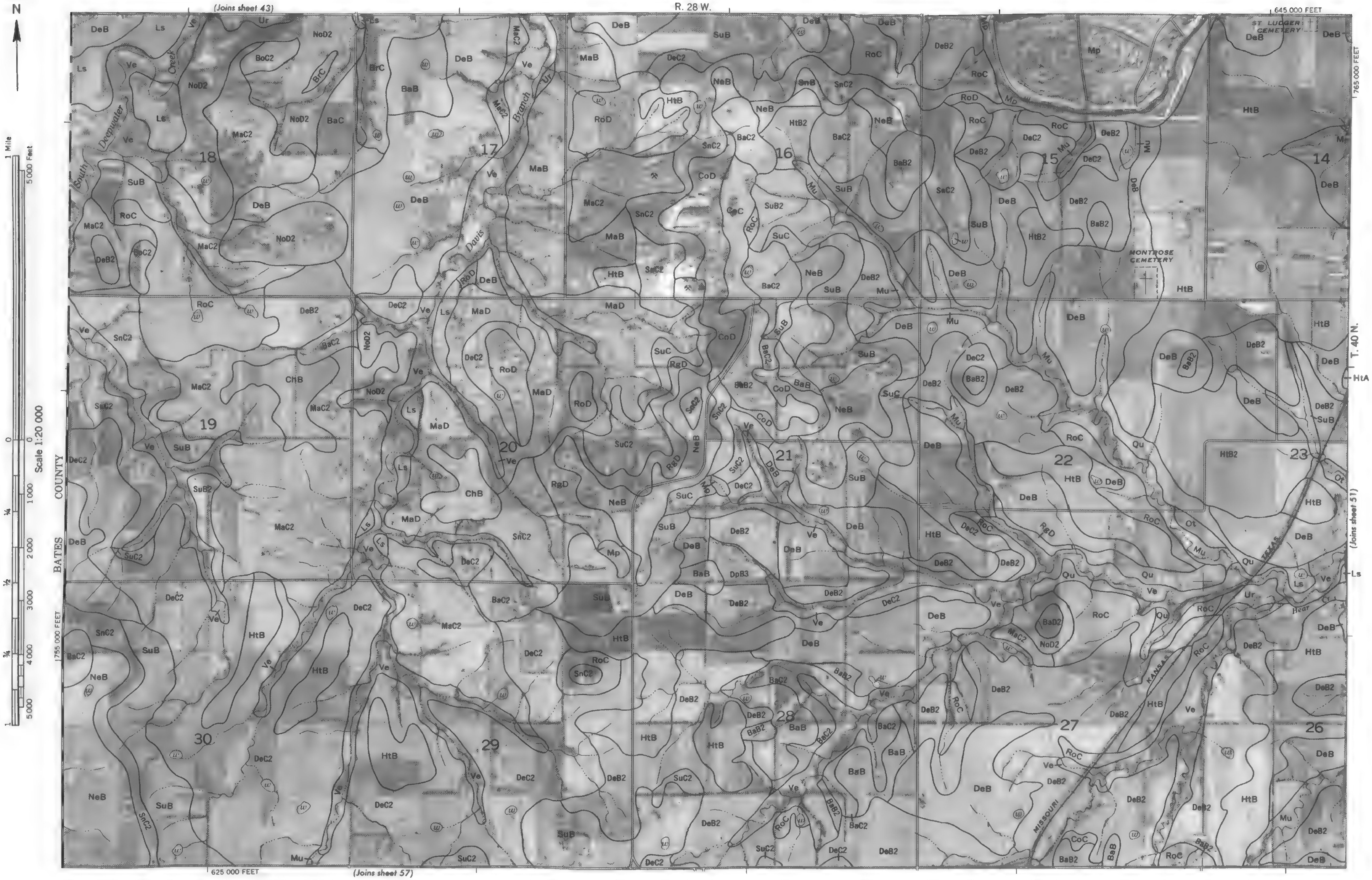
HENRY COUNTY, MISSOURI — SHEET NUMBER 50



Land division corners are approximately positioned on this map.

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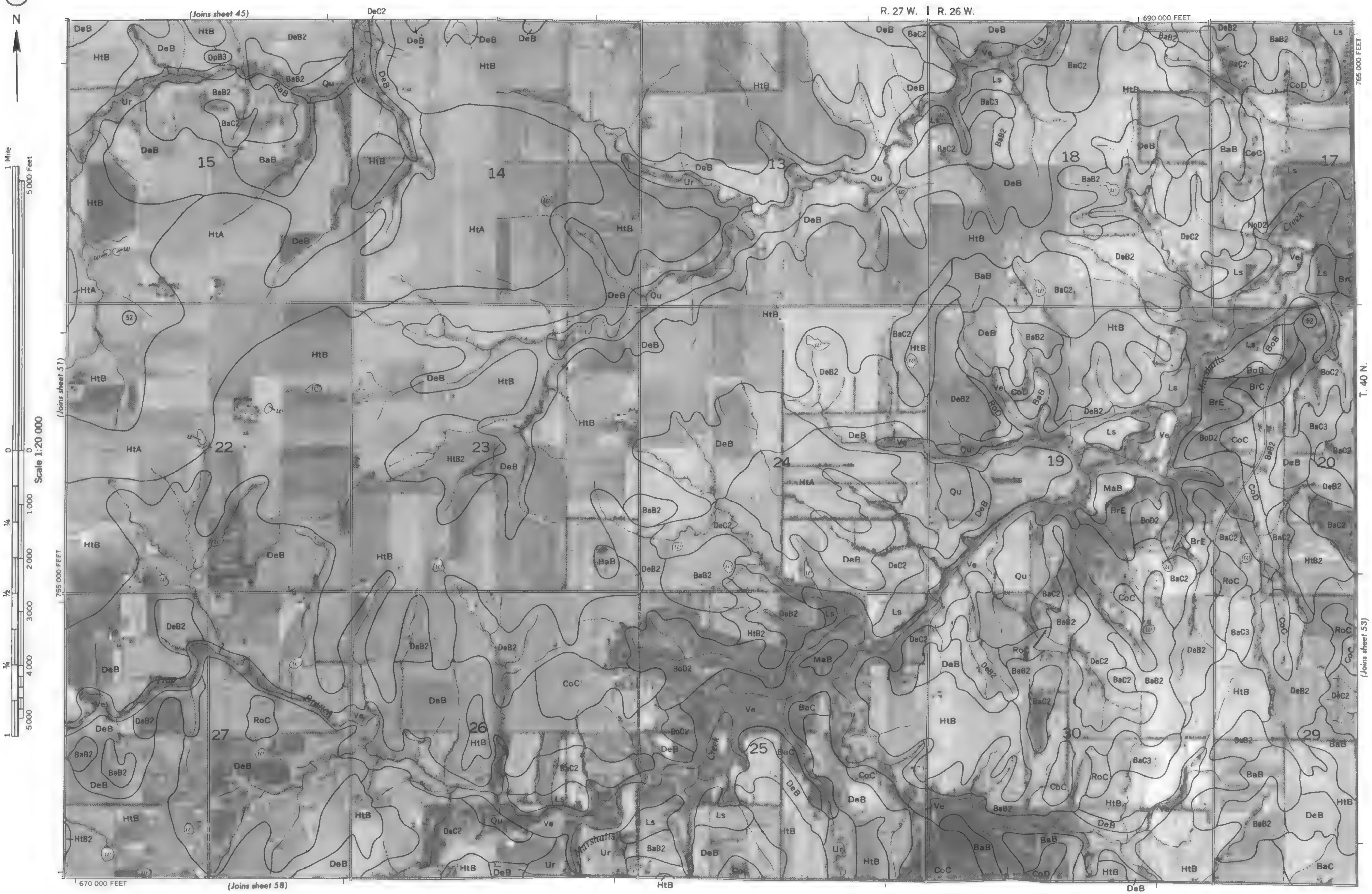
HENRY COUNTY, MISSOURI NO. 50

HENRY COUNTY, MISSOURI — SHEET NUMBER 51

HENRY COUNTY, MISSOURI NO. 51

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Missouri Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 5000-foot grid ticks are approximate and based on the Missouri coordinate system, west zone.
Land division corners are approximately positioned on this map.

HENRY COUNTY, MISSOURI — SHEET NUMBER 52



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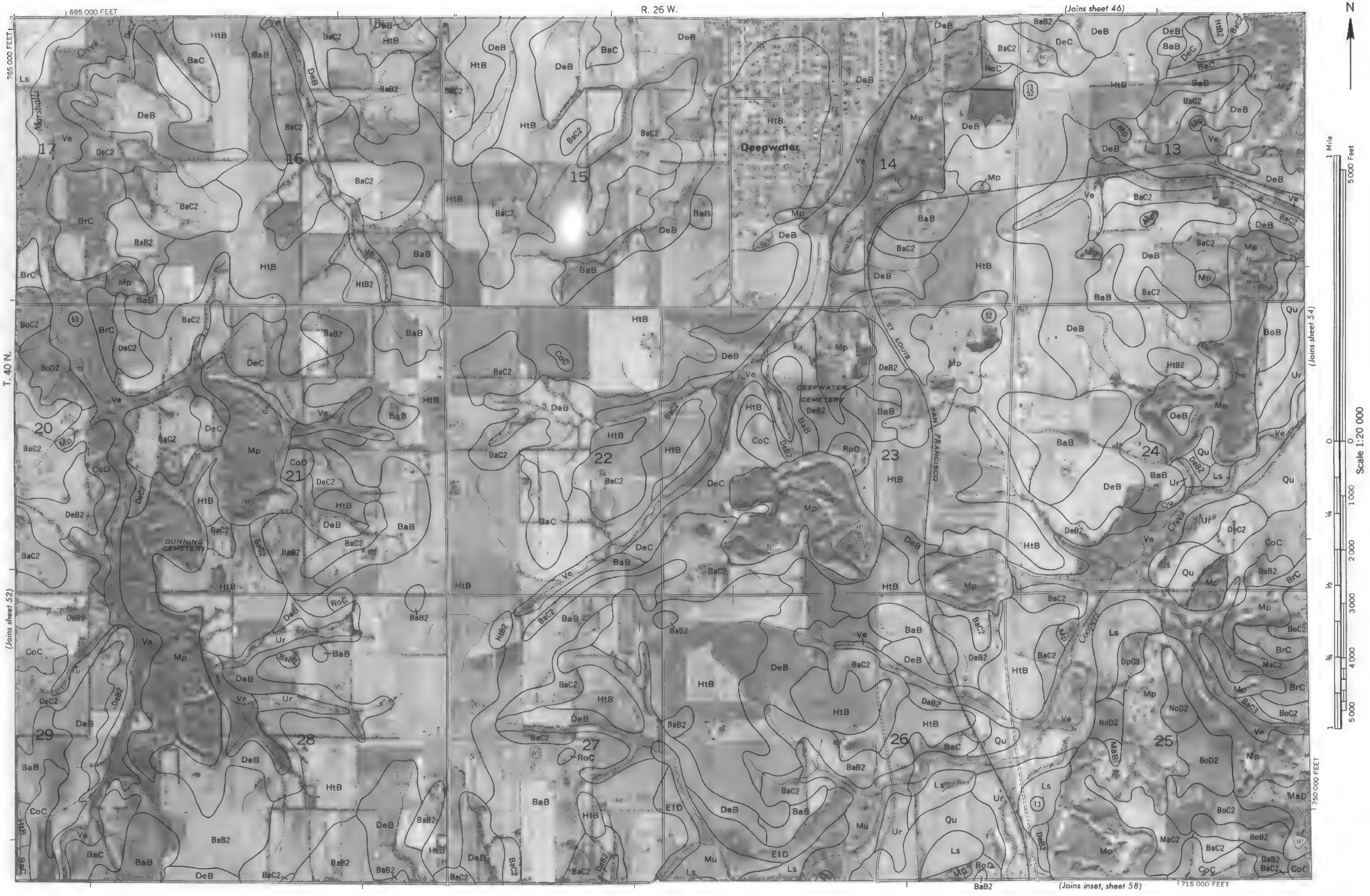
HENRY COUNTY, MISSOURI NO. 52

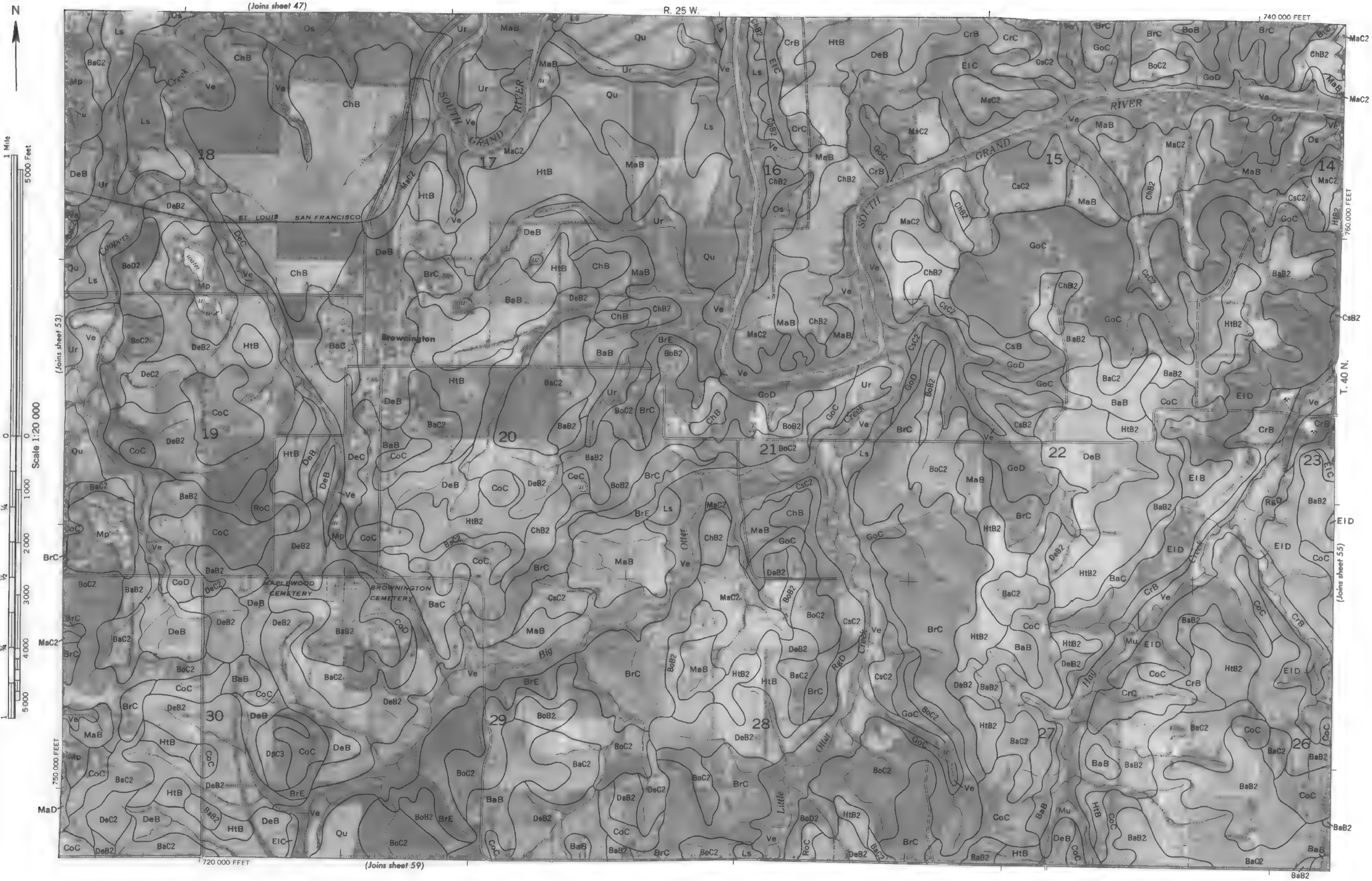
HENRY COUNTY, MISSOURI — SHEET NUMBER 53



HENRY COUNTY, MISSOURI NO. 53

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Missouri Agricultural Experiment Station. Photobase from 1971 aerial photography. Positions of 5000-foot grid ticks are approximate and based on the Missouri coordinate system, west zone. Land division corners are approximately positioned on this map.

HENRY COUNTY, MISSOURI — SHEET NUMBER 54



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HENRY COUNTY, MISSOURI NO. 54

HENRY COUNTY, MISSOURI — SHEET NUMBER 55

HENRY COUNTY, MISSOURI NO. 55

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Photobase from 1971 aerial photography. Positions of 5000-foot grid ticks are approximate and based on the Missouri coordinate system, west zone.
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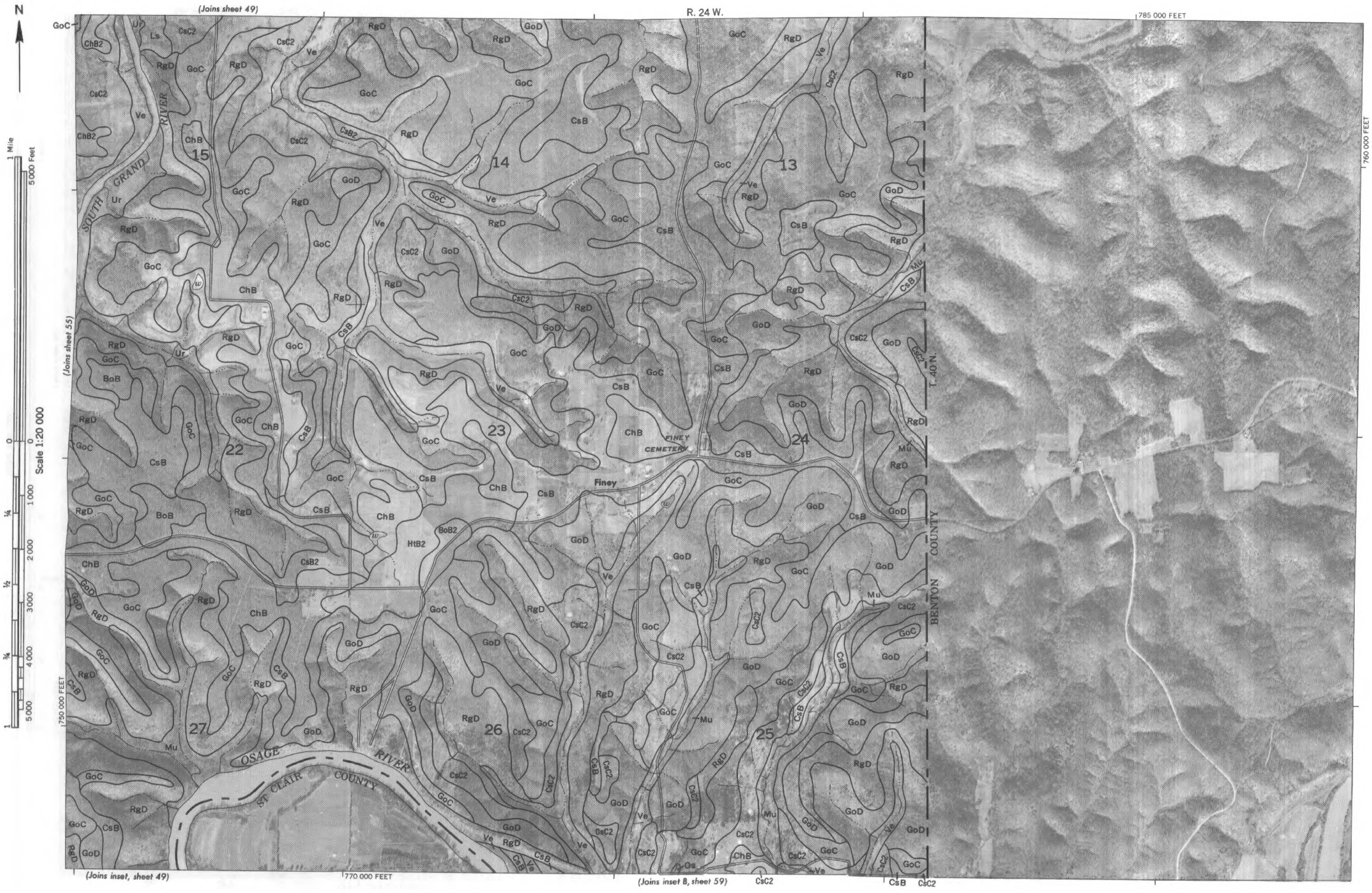

Land division corners are approximately positioned on this map.

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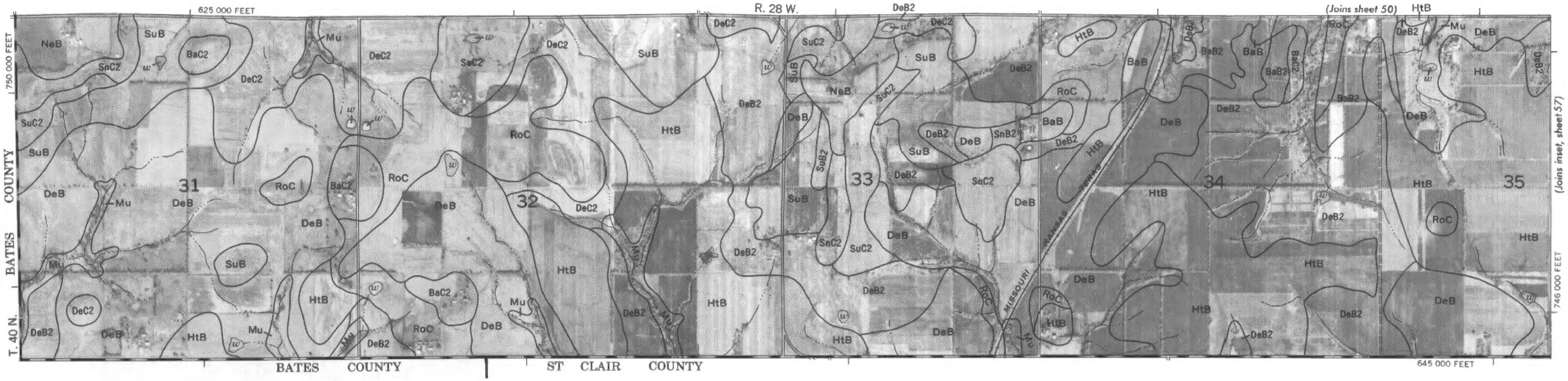
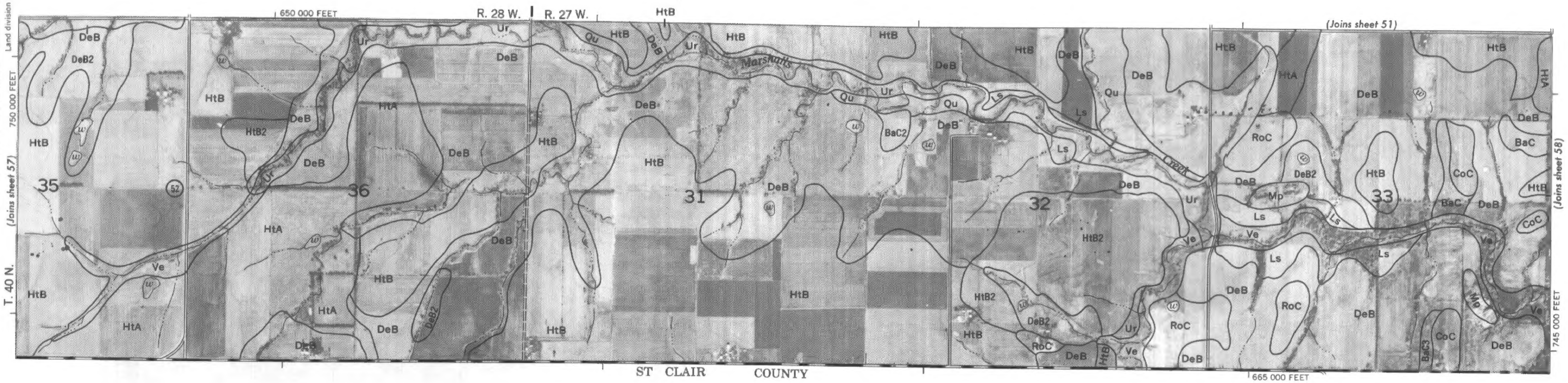
HENRY COUNTY, MISSOURI NO. 56

57



4000 AND 5000-FOOT GRID TICKS



4000 AND 5000-FOOT GRID TICKS

N

1 Mile ¾ ½ ¼ 0

5000 Feet 4000 3000 2000 1000 0

Scale 1:20 000

HENRY COUNTY, MISSOURI NO. 57

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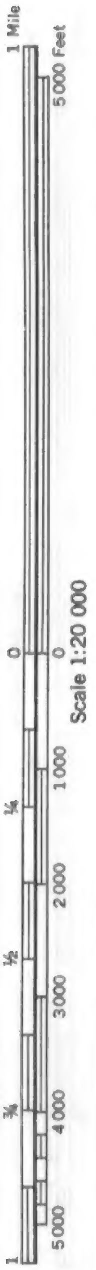
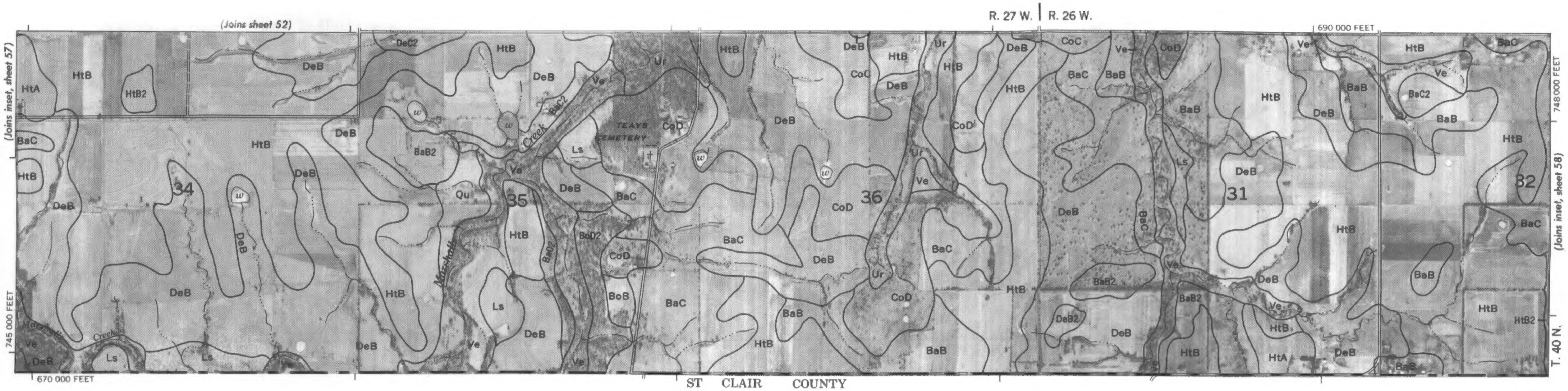
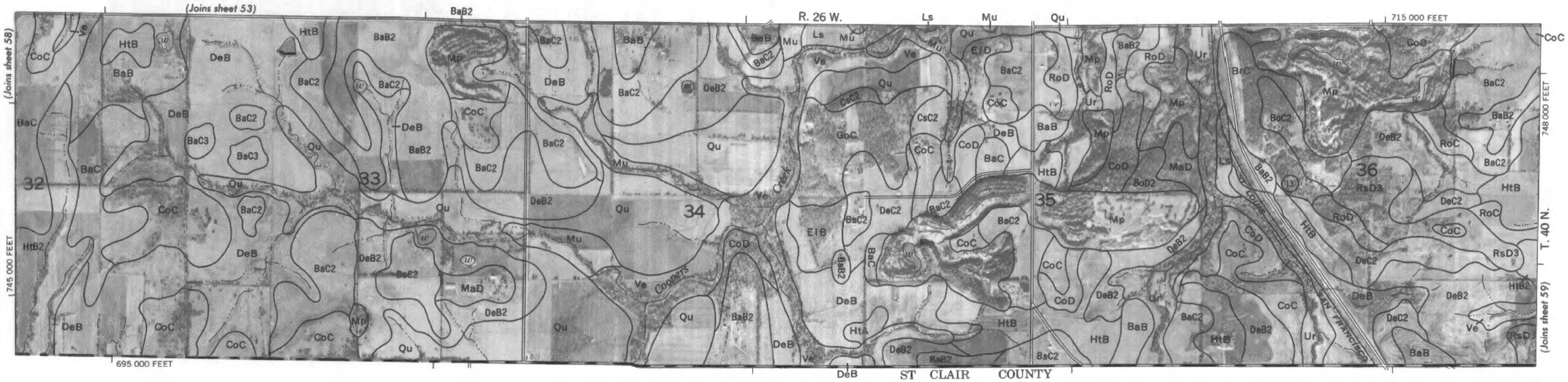
HENRY COUNTY, MISSOURI — SHEET NUMBER 58





3000 AND 5000-FOOT GRID TICKS



3000 AND 5000-FOOT GRID TICKS

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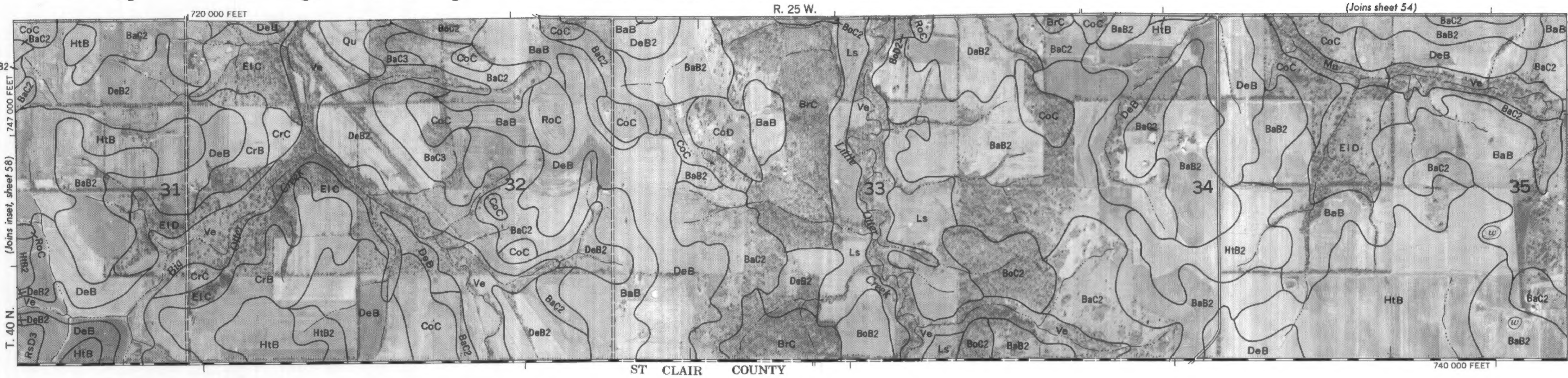
HENRY COUNTY, MISSOURI NO. 58

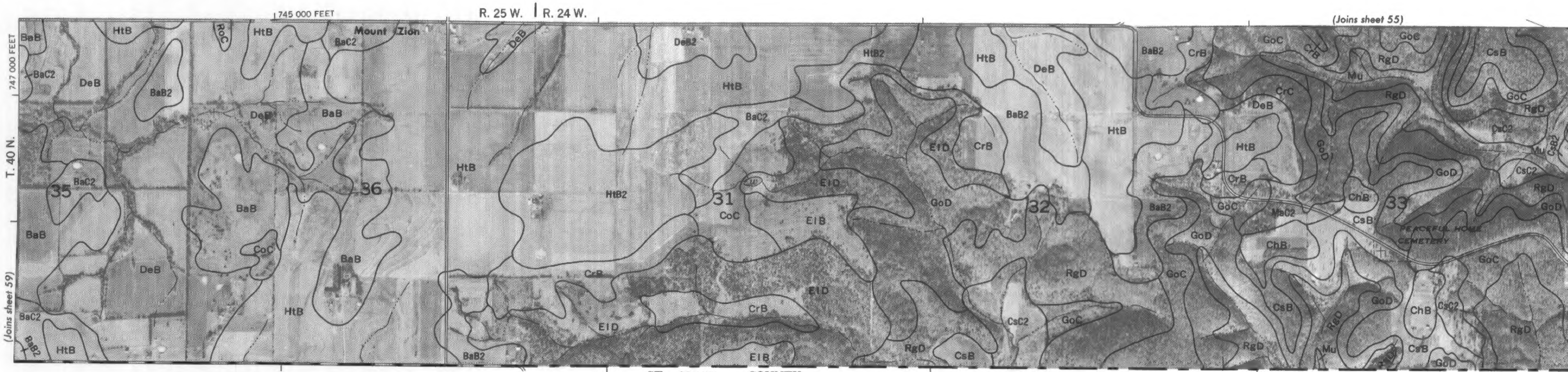
HENRY COUNTY, MISSOURI — SHEET NUMBER 59



ST CLAIR COUNTY

2000 AND 5000-FOOT GRID TICKS

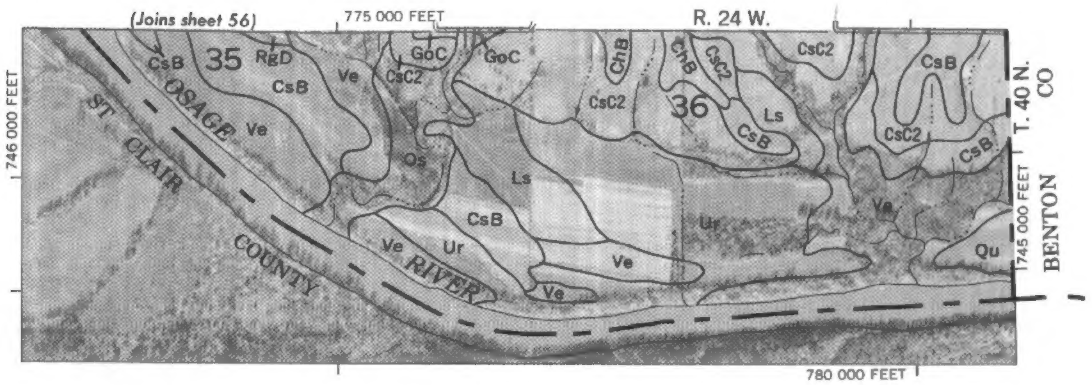
INSET A



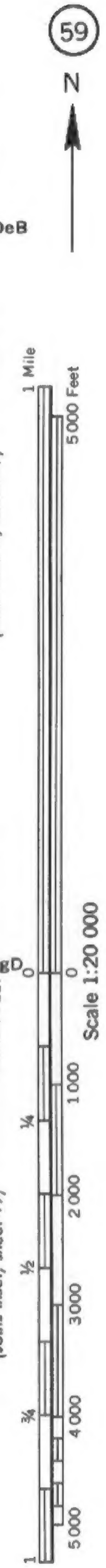
ST CLAIR COUNTY

2000 AND 5000-FOOT GRID TICKS

INSET B



1000 AND 5000-FOOT GRID TICKS



HENRY COUNTY, MISSOURI NO. 59

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